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THE PRACTITIONER.

JULY, 1907.

DIABETES MELLITUS FROM THE PHYSIOLOGICAL STANDPOINT.

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In order that the pathologist may understand the problems with which he has to deal, it is necessary that he should be provided with a groundwork of physiological knowledge. It, however, often happens that the physiologist learns a great deal about the normal functions of the body by the information which he obtains from a study of diseased and abnormal processes. Diabetes is a striking example of a case wherein both classes of investigators may derive mutual benefit from an interchange of views.

The most obvious sign of a diabetic condition is the occurrence of sugar in the urine, and it is said that the sweet taste of the urine was known to Susruta, an Indian physician of the seventh century. In Europe, the same observation was made by Thomas Willis in 1674, and another hundred years later (1775) Dobson proved sugar to be present.

We now know that the sugar which appears is dextrose. Other sugars have occasionally been observed, for instance, milk sugar in the urine of nursing mothers, and pentoses, levulose, and other rarer sugars in certain abnormal pathological conditions. These, however, are exceptional occurrences, not devoid of interest, but somewhat of the nature of accidents. In the usual sense of the word diabetes, one does not refer to such rare occurrences, and, in what I have to say, I shall restrict myself to the abnormal form of metabolism, in which dextrose only makes its appearance.

Glycosuria, however, is the mere outward and visible sign of deep-seated changes in the body. The urine is merely the channel by means of which the excess of sugar is eliminated, and the scientific student of diabetes seeks to unravel the metabolic disorder by which the increase is brought about.

The organ, which is mainly concerned in carbohydrate metabolism, is the liver, and it is therefore to the liver, and particularly to the glycogenic function of that organ, to which we must first turn our attention. This function was discovered by Claude Bernard. He found that sugar could be obtained from the liver of animals, even when, from the absence of saccharine and starchy matters in the food, none could have been brought directly to it from the stomach and intestines. He found subsequently that, if a liver is washed free from all its sugar immediately after death, it again contains sugar after the lapse of a few hours. He explained this on the hypothesis that the liver contains a store of material which is readily convertible into sugar, and this theory was proved to be correct by the subsequent discovery in the liver of a substance allied to starch, and now termed glycogen (literally the sugar-producer), or animal starch.

Although the greatest amount of glycogen is produced by the liver upon a diet of starch or sugar, as Pavy soon afterwards conclusively proved, a certain quantity is also produced upon a purely protein diet; in the latter case it must be formed by protoplasmic activity within the liver cells. Other substances (for instance, glycerin and ammonium carbonate) will also increase the hepatic glycogen, and we shall later discuss the mechanism involved in that process.

Further, it should be remembered that, although great stress is naturally laid upon glycogen as a constituent of the liver, yet the same substance is found in many other tissues, notably the muscles.

There are two chief theories as to the destination of the liver glycogen :—(1) that the glycogen is converted during life, by the agency of a ferment, into sugar, that this leaves the liver by the hepatic veins, and is thus distributed for utilisation in the tissues ; (2) that glycogen never justifies its name, but is transformed into substances other than sugar.

The former view is that formulated by Bernard, and has been adopted, more or less completely, by the majority of physiologists. The second view is that associated with Dr. Pavy's name, who denies that the liver is a sugar forming organ, but regards it as a sugar destroying organ (*i.e.*, it converts sugar into glycogen). He has been unable to find more sugar in the hepatic blood than in the portal blood. Other observers have found an increase in the sugar of the blood leaving the liver, but the estimation of sugar in a fluid rich in proteins is admittedly a matter of difficulty. Even (as the late Sir Michael Foster put it) if the increase is so small as hardly to be detected, it must be remembered that the whole blood of the body passes about once a minute through the liver, so that a very small increase each time would mount up to a large total.

Pavy denies that the *post-mortem* formation of sugar from glycogen, which occurs in an excised liver, is a true picture of what occurs during life, but maintains that it is due to a ferment which is only formed after death. During life, he regards the glycogen as a source mainly of fat, and partly of protein. It certainly is a fact that increase of carbohydrate food leads to a formation of fat in the body, and in the liver cells ; and, in support of the theory that glycogen may also contribute to the formation of proteins, he was the first to show that many proteins contain a carbohydrate radical.

At the present day, the prevalent opinion among physiologists is of a nature of a compromise between the two extreme views. The liver is, no doubt, able to convert part of its glycogen into fat, but most of its glycogen is regarded as leaving the liver as sugar (dextrose). In coming to the latter conclusion, physiologists are influenced by what they learn from surviving organs generally. An excised organ is undoubtedly on the road to death, but while it still retains vitality, the phenomena it exhibits are similar in kind to, though they may be different in degree from, those which it exhibits during life. It is impossible to suppose that, at a given moment, arbitrarily called death, an organ can turn round and do what it never did before. Even in the case of blood-coagulation, which appears to be a direct instance to the contrary, there is no doubt, from recent research, that the blood is always tending to clot even during life, and is prevented from doing so by the production of anti-substances (anti-thrombin produced in the liver), which neutralise the activity of the thrombin or fibrin-ferment.

One more detail may be added to these physiological considerations ; the kind of sugar, which leads to an increase of the hepatic glycogen, is *par excellence* dextrose ; if this is injected into the blood stream, it is gradually removed from the blood, and accumulates in the liver as glycogen ; the liver cells are able, with the elimination of water, to condense the small molecules of dextrose ($C_6H_{12}O_6$) into the heavy molecules of glycogen $(C_6H_{10}O_5)_n$ where n is a large, but at present an unknown, number. If foreign sugars, such as cane sugar or milk sugar, are injected into the circulating blood, they are simply cast out as foreign bodies by the kidneys, and not assimilated. The only other sugars which increase the hepatic glycogen, are those which belong to the glucose or monosaccharide family; notable among these, next to dextrose, is lævulose. Lævulose[1] has the same empirical formula as dextrose, but the arrangement of the atoms in its molecules is different; hence the liver cells are capable of doing what is so difficult in the laboratory, of twisting the groups of atoms into the dextrose position, and so enabling the formation of the condensed product, glycogen, to occur.

If administered *viâ* the alimentary canal, starch, and various sugars lead to glycogen formation, but this is simply because, in the process of digestion, they are converted into glucose.

Passing next from the normal to the abnormal, it cannot be doubted that a common cause of diabetes is an upset of this glycogenic function. This may be due to an increased formation of sugar from glycogen, or to a diminished formation of glycogen from the sugar of the portal blood, according as either Bernard's or Pavy's view of the liver function is adopted. As, in so many cases of diabetes, the condition may be removed by abstention from carbohydrate food, it appears probable that, in this relation, Pavy's is the more correct explanation. The organism certainly is unable to burn, that is to utilise, sugar.

There are, however, rarer cases, in which diet makes but little difference, and in these, the sugar must arise from the metabolism of the protein constituents of protoplasm.

Such a consideration gives point to the view of those who argue that diabetes is not a single disease. The term doubtless includes many pathological conditions, which all possess in common, the symptom of excess of sugar in the blood, and therefore in the urine.

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[1] The use of lævulose as an article of diet in diabetes, which was at one time widespread, was due to the belief that this form of sugar could be utilised by the diabetic patient. This idea was started by the observation of Minkowski that lævulose reduced protein metabolism in dogs from which the pancreas had been removed. In these dogs, doubtless, the power of the body to burn lævulose was normal. Careful observations, however, by Mandel and Lusk, and by v. Noorden, have shown that, in human diabetes, this is usually not the case; here lævulose has no effect on protein metabolism, and if lævulose is given it is simply excreted in the urine, just as dextrose is.

From the physiological standpoint, I can fully endorse this view, because diabetes can be produced in animals by many and diverse experimental methods, and these forms of experimental diabetes differ from one another in some important points.

It will be sufficient to mention the principal only of these methods, namely :—

1. Diabetic puncture.
2. Extirpation of the pancreas.
3. Administration of phloridzin.
4. Administration of adrenaline.

1. *Diabetic Puncture.*—Claude Bernard was the first to show that injury to the grey matter in the floor of the fourth ventricle, in the region of the vaso-motor centre, leads to glycosuria. The injury also produces a disturbance of the vasomotor mechanism, but this form of diabetes cannot be regarded as purely vasomotor in origin, since a fall of blood pressure, due to dilatation of peripheral vessels produced in other ways, is not accompanied by a diabetic condition. Claude Bernard's experiment is not devoid of interest to the medical man, because brain disease in man, especially in the region of the bulb, is frequently associated with glycosuria. There are experiments recorded which show that the liver nerves have a direct influence on the liver cells quite apart from their influence on the blood vessels ; for instance, stimulation of the vagus, and also of the cœliac plexus, leads to diminution of the hepatic glycogen, and a corresponding increase of dextrose in the blood. It may be that puncture diabetes is due to injury to or stimulation of a centre controlling the action of this secretory nervous mechanism.

The discovery of the "diabetic centre" gave rise to the erroneous idea that all cases of diabetes are of nervous origin. But the injury to the centre is only effective in its results when the liver contains glycogen. Puncture diabetes cannot be produced in an animal, in which all the store of glycogen has been depleted by fasting, Alimentary glycosuria, which occurs when sugar is given in larger amount than the liver can deal with, and which is most readily produced when the metabolic functions of the liver are "below par," also cannot be classed with diabetes mellitus in the strict sense. In puncture diabetes, and in alimentary glycosuria, there is no fundamental disturbance of the power of the organism to burn sugar; there is simply a diminution, or overstraining of the sugar-holding capacity of certain organs.

2. *Extirpation of the Pancreas.*—Minkowski was the first to show that removal of the pancreas in animals leads to a glycosuric condition. This is not due to the loss of the pancreatic juice in the intestine, but it has been assumed to be produced by a loss of an internal secretion, formed normally in the pancreas, and distributed by the blood to the tissues, where it influences carbohydrate metabolism in some way. The little groups of epithelium cells scattered through the connective tissues of the organ, looking like a number of ductless glands in miniature, and called the Islets of Langerhans, were at one time considered to be the site of the formation of the internal secretion; it has, however, recently been shown that the islets are only phases in the life history of the ordinary secreting acini, and so it is difficult to accept this exclusive view. Be that as it may, the fact remains that pancreatic extirpation leads to a variety of diabetes, and, again, these experiments on animals are paralleled by undoubted cases in man, in which diabetes is produced by disease of the pancreas.

It is probable that, in diabetes, the metabolic activity of the tissue cells is impaired in certain directions, and this leads to a diminution in oxidative processes. Nevertheless, other diseases, in which diminished oxidation occurs, are not necessarily accompanied by glycosuria, though it often is the case, as for instance in poisoning by carbonic oxide. The difficulty in diabetes probably lies in an impairment of the capacity of the cells of the body to prepare the sugar for oxidation. In this process, the sugar, or its early oxidation product called glycuronic acid, is split into smaller molecules, and ultimately leaves the body as carbonic acid and water.

The close relationship of sugar and glycuronic acid is shown by the following formulæ :—

$$\begin{array}{ccc} \mathrm{COH} & \qquad & \mathrm{COH} \\ (\mathrm{CHOH})_4 & & (\mathrm{CHOH})_4 \\ \mathrm{CH_2OH} & & \mathrm{CO{\cdot}OH} \\ \text{(Dextrose)} & & \text{(Glycuronic acid)} \end{array}$$

That is two hydrogen atoms in the CH_2OH group are replaced by one of oxygen. This oxidation is readily brought about in the body, and glycuronic acid is usually found in diabetic urine[1]; but the further oxidation into water and carbon dioxide is a more difficult task because it involves the disruption of the linkage of the carbon atoms. Perhaps it is just here that the diabetic person fails, and it may be here also that the internal secretion of the pancreas is effective. Lepine's idea was that sugar destruction, or glycolysis, was accomplished by the pancreatic internal secretion *in the blood*, and, therefore, when the pancreas was removed, glycolysis ceased, and sugar accumulated in that fluid. This was a very simple explanation, but regarded as improbable from the first, for metabolic processes do not occur in the circulating fluid any more than respiratory processes do. It has since been abundantly disproved. It may, however, still be that the active principle of the pancreatic internal secretion stimulates the glycolytic action *of the tissue cells*. Otto Cohnheim published some experiments which appeared to prove this ; for he found that extracts of pancreas, added to muscles, facilitated what did not occur markedly in its absence, namely a combustion of sugar there. Unfortunately, most subsequent observers have failed to obtain the same results, so we are still in the dark as to the exact *modus operandi* of how it is that the pancreas exercises this most important rôle.

3. *Administration of Phloridzin.*—Many poisons produce temporary glycosuria, but the most interesting and powerful of these is phloridzin. The diabetes produced is very intense. Phloridzin is a glucoside, but the sugar passed in the urine is too great in amount to be accounted for by the small quantity of sugar in the drug ; and, further, a derivative of phloridzin, which is free from sugar and called phloretin, produces the same results.

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[1] It is sometimes found in the urine independently of diabetes, particularly as the result of treatment with certain drugs, camphor, &c.

Phloridzin (or phloretin) produces diabetes in starved animals, or in those in which any carbohydrate store must have been got rid of by the previous administration of the same drug. This form of diabetes is, therefore, analogous to those intense and serious forms of diabetes in man, in which the sugar must be derived from protoplasmic metabolism. A striking feature in phloridzin diabetes is the absence of an increase of sugar in the blood; it is glycosuria without glycæmia. Moreover, if the phloridzin is directly injected into one renal artery, sugar rapidly appears in the secretion of that kidney, and, later, in that of the other kidney. The sugar in this condition must be formed by the kidney from some substance in the blood, and it is at present unknown what that substance is. It is probably protein in nature, and proteins, as we know, contain a small amount of a carbohydrate radical (a nitrogenous derivative of sugar called glucosamine); but the large amount of urinary sugar is with difficulty accounted for in this way. The mucins and mucoids of the body contain the same carbohydrate substance in much greater amount, and it has been surmised that the blood contains one of these complex proteins, which has been termed sero-mucoid, but again we have the difficulty that, if this is the means of sugar transport, the quantity of sero-mucoid in the blood is very small. The action of the kidney cells in forming dextrose has been compared with that of the mammary cells in forming lactose; but a simile of this kind does not help us very much, for it assumes that we know the way in which the mammary cells act.[1]

4. *Administration of Adrenaline.*—This is a drug which produces so many interesting results, that at least a mention of the fact that it also produces glycosuria is demanded. This is a diabetes in which glycæmia accompanies the glycosuria. It largely depends on the amount of carbohydrate in the food, but, as in diabetes generally, there is an increased decomposition of protein material in metabolism leading to an increase of the urinary ammonia and urea. Herter thought the drug operated through the pancreas, but Nöel Paton states

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[1] It is probable that the sugar originates, not from any carbohydrate radical linked to the protein, but through the intermediation of certain amino-acids, especially alanine. See more fully the small print at the end of this paper.

that this is incorrect, because in birds without a pancreas (in these animals extirpation of the pancreas does not produce diabetes in itself) the drug causes glycosuria as effectively as in normal animals. It is, however, impossible at this early stage of these investigations to make any positive statement on the cause of adrenaline glycosuria. Underhill and Closson were unable to confirm Paton's statements regarding the effect of the drug on protein metabolism; they regard the condition as essentially nervous, and consider that the poison acts on the sympathetic, so preventing carbohydrate storage, or leading to a depletion of any carbohydrate store already present.

The Dextrose; Nitrogen Ratio.—Sufficient has already been said to show that sugar may, in certain circumstances, arise not only from glycogen, but also from protein, and the fact that the nitrogen of the urine generally rises in amount is another indication of protein breakdown. Graham Lusk has made a special study of the dextrose : nitrogen ratio (D : N), and finds that in phloridzin diabetes, after all carbohydrates in the body such as glycogen have been got rid of, the ratio is a constant one, viz., 3·65 : 1. We here have a proof that, in this form of the disease, the sugar has an exclusively protein origin; indeed nearly 50 per cent. of the protein molecule must be converted into sugar. If the same ratio occurs in man (on a diet containing no carbohydrate), or any approach to it, practitioners may be quite certain they are dealing with a very serious case, and one in which complete withdrawal of carbohydrate food will produce no benefit. That a rapidly fatal issue, in such cases, may be foretold with certainty, has already been exemplified in Lusk's hands.

Acetonœmia.—This term was coined on the supposition that the poison, responsible for the coma, which so often precedes death in diabetic patients, is acetone. Acetone is certainly usually present in the urine of these cases, and its apple-like smell should always suggest the possible onset of coma and death. But acetone is not the poison, neither is the ethyl-diacetic acid (aceto-acetic acid), which usually accompanies and is the source of the acetone. Neither substance, artificially introduced into the circulation, causes serious symptoms, and certainly no narcotic results. The poison in all probability is the fatty acid called β-hydroxybutyric acid, or its amino-derivative. In these cases, the alkalinity of the blood and also its carbonic acid are stated to be reduced, and the ammonia of the urine is increased. This indicates an attempt of the body to neutralise the poisonous acid. Ammonia production is the physiological remedy for increase of acids, or, to put it more correctly, less of the ammonia which results from metabolism is converted into urea. Of late years, however, pathologists have seen reason to doubt whether acidæmia is constantly present in diabetes, and even in diabetic coma. No doubt there are other factors to be considered as well, but I feel that this is a portion of the subject which will be better dealt with by the pathologists.

In the foregoing pages, I have attempted to give an outline sketch of the subject from the physiologist's point of view. It would be impossible in the short space of an article to fill in all the details, but there are many interesting problems raised, difficult to answer in the present state of our knowledge, but concerning which we do know something. For such of my readers, who desire to follow these a little more deeply, I append an outline discussion of some of the chemical questions involved.

Origin of Carbohydrate from Protein.—We have seen that, in certain conditions, glycogen may originate from protein, and that many proteins contain a carbohydrate radical. Some of these (*e.g.*, mucin) yield a considerable amount, but in the commoner proteins the amount is in the neighbourhood of 1 per cent. or less. The mucins do not participate to any great degree in metabolism, and so the question arises whether the small amount of carbohydrate in ordinary protein is sufficient to account for the amount of glycogen formed. Arithmetic shows that it will not; moreover, such a protein as casein, which contains no carbohydrate radical at all, is equally efficacious with the others in yielding sugar, when given to animals suffering from phloridzin diabetes. We must, therefore, search for something in the protein molecule as the source of the carbohydrate, and leucine, having like sugar 6 atoms of carbon, was naturally the first substance to be examined. But all experiments on the administration of leucine led to negative, or nearly negative results. Another amino-acid called alanine (with its compounds phenyl-alanine and tyrosine) was found to be a much more probable source of the carbohydrate. The relationship of alanine to the carbohydrates is a near one, for, if HO is substituted in its molecule for NH_2, we get lactic acid, and it was found that feeding rabbits with alanine led to glycogen formation in their livers, and to the passage of lactic acid into their urine. Another protein cleavage product, called aspartic acid, acts in a similar way, and this also is easily intelligible on chemical lines, for if aspartic acid loses carbon dioxide, it is converted into lactic acid, and it is no great step from this to sugar. Glycerin, which we have mentioned as leading to an increase in the hepatic glycogen, does so probably by being converted into glyceric aldehyde, which is isomeric with lactic acid.

Carbohydrate Katabolism.—The final products of combustion are carbonic acid and water, but what are the intermediate steps? We have already noted that glycuronic acid is one, and it appears that lactic acid is another. Lactic acid may thus be a stage, not only in building up of carbohydrate molecules, but also in their breakdown. We know, for instance, that certain micro-organisms can convert sugar into lactic acid, and so we presume that the cells of higher organisms can do so also. The atoms in lactic acid ($C_3H_6O_3$) are in the same proportion as in sugar ($C_6H_{12}O_6$), but of course they are differently arranged, and the rearrangement, involved in the transformation, is differently explained by different chemists. The principal lactic acid found in the body is the dextro-rotatory variety (sarco-lactic acid), whereas that formed in the fermentation process, *e.g.*, in milk, is the optically inactive variety. The sarco-lactic acid is mainly of protein origin as already explained. If we admit that some of the lactic acid is of carbohydrate origin (and the admission is quite justifiable) it is important to remember that such a breakdown of sugar yields no heat, the calorific value of sugar and lactic acid being equal. In other words, the transformation of sugar into lactic acid involves no transformation of energy: there is no formation of animal heat, or of its equivalent, in work, and so the change is merely preliminary to a further oxidation into water and carbonic acid, in which there will be that liberation of energy, which it is the main object of carbohydrate breakdown to accomplish. It is just here, we have seen, that the diabetic patient fails, and sugar, which is not utilised by the body as a source of energy, is useless to the economy.

Relationship of Fat and Carbohydrate.—Just as carbohydrate in the food is the usual source of carbohydrate in the body, so the fat of the food is the usual source of fat in the body. But fat in the body may also arise from something which is not fat in the food. Whether fat may arise from protein is exceedingly doubtful; at any rate, the main proof, adduced by those who believed in it, has been shown to be fallacious, for every case of so-called fatty degeneration in protoplasm has been shown to be due either to an infiltration of fat transported from elsewhere, or to a transformation of the fat previously present in the protoplasm, although not in the form of droplets visible to the microscope.

There is, however, no doubt that the body fat may arise from carbohydrate food; this is a physiological fact which was first firmly established by the classical experiments of Lawes and Gilbert on the fattening of sheep fifty years ago. The power to accomplish the change is at present a monopoly of the living cells; chemists have never been able to perform it, and so they at first regarded it as fiction. How the long carbon chains of the fat are linked together from the shorter chains of sugar is at present a riddle, which they are seeking to solve.

More than this, we now know that fat may be converted into carbohydrate. This occurs in vegetable life where seeds rich in oil lose a good deal of it on germination, and the lost fat reappears as starch. In animals, glycosuria, produced by phloridzin, or extirpation of the pancreas, is intensified by the giving of fat. Pflüger fed diabetic dogs on pure protein, and they continued to be diabetic; the sugar must, therefore, have come either from the protein given, or from the fat of their body. On many grounds, he decided it came principally from the fat; certainly every trace of fat had disappeared from their bodies, when later on they were killed. The seat of conversion of fat into sugar is the liver; in diabetic patients the liver is always the richest in fat; so it was with Pflüger's dogs. The fact that ammonium carbonate increases the sugar in diabetes is attributed by him to the stimulating effect this salt has on the functions of the liver, not only in relation to urea formation, but also in connection with the transformation of fat into sugar. We have already mentioned the chemical difficulties of explaining how sugar can be converted into fat; the difficulty of explaining the converse change is equally great.

Pflüger has always strenuously resisted the notion that protein is a source of carbohydrate, although to most people the fact that his dogs received only protein food would appear to support this view. That such a keen observer as Pflüger has come to the opposite conclusion that, even in this case, fat is the real source of the sugar, will indicate to the reader how difficult the problems of metabolism are. We have already considered other proofs that carbohydrate does arise from protein, the chief of which is the constancy of the D : N. ratio in certain cases of diabetes. There is, however, no reason why anyone should pin himself to an exclusive view. The methods of change and interchange in the body are multifarious; it is quite possible that sugar may arise both from protein and from fat.

Fat Katabolism.—The fats on combustion yield the same ultimate products as the carbohydrates, namely, carbonic acid and water. A great deal of the oxygen we take in is used for burning fats with the simultaneous liberation of work and heat. Fats share with sugar an important place as a source of muscular energy, and muscles, which are perpetually at work, like the heart and the diaphragm, are richest in fats. But how the long carbon chains of the fats are taken to pieces and burnt up is almost entirely a matter of guess-work. A study of acetonæmia has, however, shed an unexpected ray of light on the problem. It has been shown that butyric acid and β-hydroxybutyric acid are probably intermediate stages before the final simpler products are arrived at. The hydroxybutyric acid formed in diabetes is by oxidation partly converted into aceto-acetic acid, and, in the urine, this loses carbon dioxide, and so is partly converted into acetone. This group of products was at one time thought to originate from proteins; this cannot be so, because there is no corresponding increase in other protein-katabolites in the urine. Acetonæmia can be produced in healthy people by cutting off their carbohydrate food; if sugar is then added to the diet acetonæmia ceases, but if fat is added instead the acetonæmia increases; fat also increases acetonæmia in diabetes. If butyric acid and β-hydroxybutyric acid are normal intermediate products in fat katabolism (and all the facts point to the truth of this supposition), a healthy man, under normal conditions of diet, is able still further to oxidise them into carbonic acid and water; the man, on an abnormal diet, or, what is more to our immediate purpose, the diabetic patient, breaks down at this important point just as he also fails at a corresponding critical point to oxidise the intermediate products of carbohydrate cleavage into the same final simple materials.

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THE PANCREAS AND DIABETES MELLITUS.

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THE association of lesions of the pancreas with diabetes, or, at any rate, with one variety of diabetes, was first maintained by Lancereaux, some thirty years ago; although it was not until 1890 that experiment proved that the removal of the entire pancreas, in animals, was invariably followed by the development of a severe and fatal glycosuria. The variability in the association of glycosuria and pancreatic lesions, in the human subject, led many clinicians to doubt whether there was any exact and constant relationship between diabetes and pancreatic disease. This is one of the many subjects in medicine, in which experimental research has been the means of clearing up difficulties in the interpretation of symptoms, and in which the aid of morbid anatomy alone was not sufficient for the purpose. Experiment showed that, for glycosuria to be produced, it was essential that the entire pancreas should be removed, and experiment also showed that glycosuria could be produced by many other procedures besides the removal of the pancreas. Thus the facts that glycosuria and diabetes were not associated with all lesions of the pancreas, and that diabetes might exist apart from pancreatic disease, were no longer stumbling-blocks in the way of the acceptance of the conclusion that some forms of diabetes were associated with some pancreatic lesions.

The controversies, with regard to the relation existing between pancreatic disease and diabetes, are somewhat similar to those formerly prevalent, with regard to the connexion between disease of the suprarenals and the clinical state known as Addison's disease, and the same arguments were largely adduced in both cases. The difference, however, would seem to be that whereas Addison's disease can only be due to disease of the suprarenals, diabetes is really a complex group, and only one form of it can be correlated with pancreatic disease. In other words, diabetes is not an entity, but a clinical label, attached to a number of different conditions, with probably varied origins, different morbid anatomy, and liable to follow different courses. Lancereaux regarded pancreatic diabetes as a severe form of diabetes, characterised by rapid wasting, great thirst, and a high degree of glycosuria, and, at the present time, this view is still very largely held, and only the graver forms of diabetes are attributed to pancreatic disease.

Amongst the lesions of the pancreas, most commonly associated with severe diabetes, atrophy and fibroid overgrowth stand out as the most common, and, in many instances, atrophy and fibrosis coexist in the same case. Fatty degeneration, cystic disease, calculi, and even such acute lesions as hæmorrhagic, and suppurative pancreatitis are sometimes present, but the presence of glycosuria and diabetes is decidedly exceptional in such diseases. Further, it is uncommon for glycosuria and diabetes to be associated with carcinoma of the pancreas, although, from time to time, striking instances of this association may occur. One such instance has fallen under my own observation, in which diabetes and ascites developed rapidly, and almost simultaneously, in a middle-aged man, and in which, after death, malignant disease of the pancreas was found. Still, in the great majority of cases of malignant disease of the pancreas, diabetes is not present, and it is not very common for even transitory glycosuria to occur in such instances. Most of these pancreatic lesions, unaccompanied with diabetes, are lesions that involve, and destroy only a portion of the gland, whereas atrophy and fibrosis are more uniform and general in their distribution through the pancreas, this is usually regarded as affording the explanation of the absence of diabetes in cases of malignant, cystic, and other local diseases of the pancreas. The experimental results, obtained in animals, have shown that a very small remnant of pancreas is sufficient to prevent the development of glycosuria. Although atrophy and fibrosis are frequently associated with diabetes, and must, in such cases, be looked upon as the causative lesion of the glycosuria, yet fibrosis of the pancreas may exist without the development of diabetes, and investigation has shown that two forms of interstitial fibrosis of the pancreas may be recognised. One, an interlobular fibrosis, where the increased fibrous overgrowth is limited, as the name implies, to the interlobular connective tissue. This form of fibroid pancreas may be associated with the presence of fibroid overgrowth in other organs, *e.g.*, liver, spleen, kidneys, etc. In the second variety, the fibrous overgrowth in the pancreas is not confined to the interlobular connective tissue, but involves the gland throughout, and is, therefore, interacinar and intralobular.

The interlobular form is the more common, and, not uncommonly, is a sequel of blocking of the pancreatic duct, or of the bile duct, and is not necessarily associated with diabetes. The interacinar, or interlobular, variety, on the other hand, is the form peculiarly associated with diabetes according to Opie's results. This observer regards the presence, or absence, of diabetes as dependent on the destruction, or integrity, of the islands of Langerhans in the pancreas. These islets of cells are liable to escape degeneration in the interlobular form of chronic pancreatitis, whereas they undergo degeneration in the intralobular form of the disease. According to this view, the variety of diabetes, associated with pancreatic lesions, would really be dependent, in a considerable proportion of cases, on a peculiar form of chronic pancreatitis, leading to a diffuse intralobular fibrosis of the gland, and causing degeneration of the islets of Langerhans. Whether or no diabetes can be attributed to destruction of the islets of Langerhans is perhaps doubtful, but the experimental results certainly associate the glycosuria with the loss of an internal pancreatic secretion, and Opie's results seem to show that, in diabetes, the islets of Langerhans have undergone degenerative changes, whereas they escape in the chronic pancreatitis, unaccompanied with glycosuria.

In conclusion, attention may here be drawn to some interesting cases in which glycosuria and diabetes developed after the occurrence of an illness, which might possibly be regarded as due to pancreatic disease, and which have fallen under the observation of the writer.

A woman, aged 62, whose urine was normal, and contained no sugar, was operated on, in 1903, for a large, hard, rounded, and painful swelling in the epigastrium. This tumour, when exposed by laparotomy, was found to be a hard mass behind the stomach in the region of the pancreas, and the omentum was studded with numerous small white masses. The wound was closed as the mass could not be removed. Three years later, the patient again came under observation, suffering from diabetes of a severe type, and, on examination, there was no tumour to be detected in the abdomen. It is possible that this was a case of chronic pancreatitis, and that the subsequent atrophy of the gland was accompanied by the development of diabetes.

In a second case, also a woman, a large abdominal tumour caused sufficient pressure on the pylorus to necessitate gastro-enterostomy, in order to relieve pyloric obstruction, the tumour itself not being capable of removal. Eighteen months after this operation, the patient presented all the signs of very severe diabetes, and the tumour was no longer to be detected. In both these cases the patients were greatly wasted, and the abdominal examination presented no difficulty, and formerly the tumours were readily detected.

These two cases present many points of similarity, and certainly suggest the view that some pancreatic lesion, such as chronic pancreatitis, gave rise to signs suggesting the presence of a malignant growth, and the subsequent disappearance of the tumours was accompanied with the development of very severe diabetes.

The third case was that of a woman, aged 30, who apparently suffered from an attack of so-called catarrhal jaundice. When the jaundice had subsided, diabetes of a severe type suddenly developed, the urine being greatly increased in quantity, and containing a large amount of sugar. Under strict dietetic treatment, the glycosuria diminished. Some cases of catarrhal jaundice have been attributed to swelling of the head of the pancreas as a result of pancreatitis, and it is, therefore, possible that the illness, from which this patient suffered, was of this character.

THE BASIS OF THERAPY IN DIABETES.

By I. WALKER HALL, M.D.,

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It is sometimes a little hard to realise that, in diabetes, the cells of the tissues are immersed in a fluid containing a carbohydrate, which they sorely need, but which they are unable to appropriate. In response to the call from these cells, the carbohydrate-producing organs are working at high pressure to turn out quantities sufficient for the indicated requirements. Thus the blood and lymph are flooded with material which the cells are unable to utilise. The stream, with its dissolved carbohydrates, passes on—leaving the essential cells of the organism starving from the lack of power to grasp the opportunity—and, in order to maintain the solution of its contents, abstracts water from the tissues through which it courses. This augmented stream flushes the kidney with an amount of sugar too great for the renal cells to hold back, and glycosuria results.

The cells of the diabetic individual do not, however, succumb to an acute starvation. The condition is one of underfeeding, for the comparative chronicity of the condition indicates that the cells, in some way, satisfy their immediate carbohydrate necessities. Perhaps the different types of cells may vary in their powers of assimilation, and one group may compensate for another; for instance, the leucocytes and renal cells, by an excessive intake, may, to a certain extent, balance the lessened utilisation by the fixed tissue cells.

Every diabetic patient manifests a different degree of inability to utilise carbohydrates, and his powers often vary during the course of the disease.

The several carbohydrates also appear to play a part: lævulose, as a rule, is utilised better than maltose or dextrose. Dextrose is, by some, dealt with more easily than maltose.

The place of intake is also a factor to be considered. Dextrose, given *per rectum*, is much better borne than when taken by the mouth.

Within the scope of this paper, it is not possible to include the entire range of the abnormal metabolism. Many points are therefore omitted, and the writer, while regretting the necessary limitations, has restricted himself to a line of thought which may, perhaps, suffice to suggest to the reader certain points worthy of further observation.

The Condition of the Tissue Cells in Diabetes.

The tissue cells, which comprise the normal depôts for the storage of glycogen, all exhibit poverty as regards this substance; in fact, they are more or less unable to take up the sugar from the lymph-stream. Other cells, such as leucocytes and the cells of Henle's renal tubules, assist them by assuming the lost function, but the amount stored in this way is utterly inadequate for the needs of the tissues.

When lævulose is substituted for glucose, the cells partially replenish their glycogen store. Some of the lævulose is changed to glycogen in the liver, but a portion of it passes through, and reaches the tissue cells unchanged. The power of the cells to utilise this sugar varies in different diabetics, and in the same diabetic at different periods, and it is considerably diminished if the lævulose administration is continued over too long a period.

This attitude of the cells towards carbohydrates is also reflected in their action upon protein. The protein derived from the tissues is broken down differently from that contained in the food, the latter yielding more sugar.

The synthesis of fat from the unused carbohydrate is, as a rule, diminished in diabetes. The cells appear to be unable to utilise the carbohydrate, which is not required by the muscle and glands, for the formation of fat. It is possible, however, that there is an intermediate stage, in which the power of using sugar is lost, but the power of forming fat is retained. At this period some of the unused sugar would be built up into fat, while only a small remainder, if any, would reach the urine. Adiposity would result from the inability of the cells to use the sugar, and the fat formation would mask the diabetic condition of the cells. From the statements of the capacities of the tissue cells in diabetes, we may classify, after von Noorden, the stages of the tissue changes in the following way :—

1. Cases in which the combustion of sugar, and its conversion into fat, are defective. Ordinary diabetes (glycosuria and wasting).

2. Cases in which the combustion of sugar is defective, but its synthesis into fat is normal. Masked diabetes (obesity without glycosuria).

3. Cases in which the combustion of sugar is defective, and in which the synthesis of fat begins to fail. Diabetes of obese people (obesity with subsequent glycosuria and wasting, ultimately passing to the ordinary diabetes).

Naunyn thinks that the defective formation of fat is rather a question of time, than of the extent of the process.

Why is the Over-production of Sugar continued? How may the Cells obtain the required Carbohydrate?

The appetite of the diabetic is generally good. The salivary, gastric, and intestinal secretions are normal in quantity and quality. The motility of the stomach is but rarely impaired. Absorption is regular and complete.

The continual drain of sugar from the organism represents a loss of energy, which calls for replacement. The formative tissues respond to the want by the production of the carbohydrate desired, and it is sent along to the cells. The cells cannot use it, and it passes by them. Still the cry for more carbohydrate goes forth. Additional sugar is poured into the blood-stream, but it cannot be assimilated. The sugar hunger of the cells continues; the production of sugar is being constantly stimulated; hyperglycæmia results.

This increase of sugar in the blood has been attributed to nervous or hepatic causes, or to a combination of both; or to an excess of carbohydrates in the food; or to an altered interaction between the ductless or blood glands; but the altered function of the pancreas is the most constant cause. At one time, it was suggested that atrophy and hyaline changes in Langerhans' islands were probable causes of the condition. Lately the administration of the extract of duodenal mucosa has, in a few cases, successfully incited the pancreas to the secretion of the material which the cells require for their "chaining" of the carbohydrate. More recently, MacCallum points to the hypertrophy of the Langerhans' islands in diabetes as an important factor in the condition, and perhaps representing an attempt to produce the necessary "complement," or internal secretion, which is necessary for carbohydrate metabolism.

It may now be useful to briefly review the sources of the hyperglycæmia, when the carbohydrate intake is restricted.

1. *Protein* may be utilised for this purpose. The protein nucleus can be combined with a carbohydrate group forming a type of glucoside. The following table shows an increase of glycosuria following protein intake (von Noorden) :—

Diet.	Sugar in Urine.
	gm.
1. Ordinary strict diet	57·1
2. Vegetable diet	30·2
3. ,, ,,	11·9
4. Vegetable diet plus	2·1
300 gm. meat (weighed raw)	7·8
5. ,, ,, ,, ,, ,,	22·8
6. ,, ,, ,, ,, ,,	33·5
7. ,, ,, ,, ,, ,,	36·7
8. ,, ,, ,, ,, ,,	42·3
9. Vegetable diet alone	8·1
10 ,, ,,	(Trace.)

The proteins differ in their yield of assimilable carbohydrates.

Proteins derived from the breaking down of cell protoplasm hardly increase the glycosuria at all, the carbohydrate split off being well utilised by the cells.

Vegetable proteins, and egg albumin, produce a slight glycosuria. They are broken down slowly, and so perhaps their products are better tolerated.

Casein and meat protein considerably increase the glycosuria.

2. *Protein Decomposition Products, Amino Acids, etc.*—The

following table shows how the amino-acids affect the production, and excretion of sugar (Embden and Salomon):

Amino-Acid.	Sugar in Urine.		
	Before	Day of Administration.	Day after.
	gm.	gm.	gm.
Alanin - -	6·20	19·50	3·60
Asparagin - -	1·70	8·48	2·45
Glycocoll - -	2·45	7·90	3·00

These figures are the results of some very promising lines of research, and call for careful attention. They point the way to some important developments, for it is evident that if, in addition to the simple splitting off of the preformed carbohydrate group from the protein, the remainder can yield a sugar molecule, then the organism may resort to this latter method of obtaining carbohydrate, when the available carbohydrates cannot be assimilated.

3. *Fat.*—It is probable that the aliphatic mon-amino-monocarbon acids, derived from the protein molecule in the body, are broken down into fatty acids, and that sugar is then formed from the fatty acids. The most likely occurrence is, however, that we have here to do with a "facultative formation"; in other words, fat is only used for the synthesis of sugar as a last resort.

An attempt has been made by v. Noorden and Embden to explain the abnormally continuous supply of sugar by the diabetic tissues. Embden and Almagia first showed that lactic acid can be formed from sugar by the liver, and v. Noorden and Embden premise that a similar formation of lactic acid takes place in the muscles. It is well known that lactic acid is present in the blood during and after muscular exertion, and the hypothesis is advanced that some of this is built up again into sugar. Ablation of the liver is followed by the disappearance of sugar from the blood-stream, and the appearance of an increasing amount of lactic acid. Is this because the removal of the liver tissue has withdrawn a ferment which converts lactic acid into sugar? Were it possible to answer this query in the positive, then it lies near to hand to think of the "lactic acid" being increased in diabetes, and acting as an inciter of the increased production of sugar, and perhaps also as constituting the basis for its formation.

How may the Carbohydrate Assimilation be Improved?

Sufficient evidence exists to show that the energy exchange of the diabetic patient is practically the same as that of the healthy individual. It is also clear that the breaking down of protein and nuclein is abnormally large in diabetics. It may be said of the diabetic patient that he has a larger daily turn over than that of the healthy individual, but that he is rarely able to add anything to his reserves. He has to sustain a big output with an insufficient capital. A large regular intake is therefore an absolute necessity. Under-nutrition is his greatest danger. It is to this, and against this, that the attention of the therapist is necessary.

The insufficient nourishment of the cell, whether from a decreased intake of carbohydrate, or protein, or fat, necessarily compels the modification of metabolic processes to the new conditions. The minimal exchange, however, cannot be reduced, and, of each type of food, there is a minimal amount, which cannot be reduced without endangering the actual life of the cell.

To obtain this minimal quantity, the cell probably adopts chemical processes which, although unorthodox, yet serve to provide the nutrition required. These unusual methods are not, as a rule, entirely innocuous; abnormal, intermediate, or by-products result, and these may exert a harmful action upon the tissues generally. These are generally acid in nature, and tend to lower the alkalinity of the blood and lymph streams. Further alterations from the ordinary course of metabolic changes are then necessary, and certain bases are utilised for this purpose, which, in ordinary circumstances, would have been otherwise excreted. Hence the occurrence of these intermediate products of abnormal metabolism is indicated by the excretion of an excess of ammonia, acetone, and acetic acids. It has been definitely established that the quantities of these substances, which occur in the urine, vary directly with the extent of the impairment of the assimilative powers of carbohydrates.

We have therefore to consider not only how the activities of cellular metabolism may be raised with regard to carbohydrates, but also how the cells may be protected from the injurious effects of incomplete or abnormal metabolites.

The extent of under-nutrition may be roughly gauged by the amount of ketone excreted. The term ketonuria includes the acetone bodies, acetic, and oxybutyric acids.

Increased Ketonuria.—This may be brought about by an intake of lower fatty acids, particularly butyric, acetic, caproic, and valeric acids. Hence the butter used by the diabetic patient should be well kneaded in cold water before being eaten.

The higher fatty acids exert a similar, though less intense, action, since they pass through the stage of the lower fatty acids during assimilation.

Amino-acids, such as leucin, also appear to increase the output of ketone.

Decreased Ketonuria.—Starches and hexoses inhibit the ketonuria in proportion to the extent to which they are utilised. The raising of the tolerance for carbohydrate results, therefore, in a diminution of the ketonuria.

Albuminates, pentoses, glyconic acid, glycerine and citric acid, all favourably affect the ketone excretion. Much still remains to be discovered as to the stage of the disease at which the action of these substances is most marked, and there is every probability that further observations will add to the number of these ketone inhibitory bodies.

The amino-acids under certain conditions may also decrease the output of ketone.

The administration of fat is not followed by an increase in the ketonuria, when the patient is able to satisfactorily utilise 80 to 100 grammes of carhohydrate per 24 hours.

In view of this relation of carbohydrate tolerance to the output of ketone, we may next review the means we possess for controlling the glycosuria, and for aiding carbohydrate assimilation by the cells.

Conditions which influence the Glycosuria.

Lævulose is associated with decreased glycosuria.

Glucose, given per rectum, has been found to cause less glycosuria than when given by the mouth (calculated for the actual quantity absorbed).

Potato and oatmeal starches produce less glycosuria than the starch contained in bread. Whether this is due to differences in constitution, or to the amount of potassium present, is not yet decided.

Albuminates, speaking generally, increase the glycosuria in slight as well as in severe cases.

Alcohol, in medicinal doses, very frequently diminishes the glycosuria; when taken in excess, a marked increase results.

Secretin has been found to act favourably upon the sugar excretion in a few acute cases; in chronic cases, negative results have been frequently obtained.

Free "sweating" lowers the sugar output.

Walking exercise and muscular work diminish the glycosuria.

Hot baths and high frequency currents are also followed by a lessened sugar output.

In the two latter instances, the effect has been most probably obtained by the rise in the general "tone" of the tissues.

Before we proceed to discuss the methods at our disposal for the application of the facts just cited, a few of the less known conditions, associated with *acidosis*, may be referred to.

The lowered alkalinity of the tissue fluids, and the consequent increased excretion of ammonia, have been already mentioned. It is worthy of note that, while the fixed alkalis of the blood, the muscles, and the glands are unaltered, those of the bones are markedly decreased. The output of magnesium, phosphorus, and calcium exceeds the intake. This explains the tendency to the atrophy of the bones in diabetes.

Acidæmia by itself is, however, quite insufficient to account for the pathological changes with which it is associated. The whole protein metabolism appears to be thrown into disorder by the deficiency of the carbohydrate assimilation, and, it is most probable that abnormal substances are formed, which we cannot as yet identify, but which doubtless play an important part in the intoxication, associated with the late and severe stages of diabetes.

The Determination of the Requirements of the Cells.

The exact details of the intake in diabetes are discussed in the section on therapeutics. Here we are only concerned with estimations of the fluids, which convey the nutriment to the cells, and carry away the rejected substances and excretions from the cells. It will be evident that, by systematic use of the methods available, valuable indications are obtained for the management of the diabetic patient, and for the treatment of his symptoms.

The *blood* may be first considered.

In uncomplicated cases of diabetes, the total and differential blood counts are unaltered. When complications arise, the hæmoglobin and red cells decrease more rapidly than in the normal individual. The molecular concentration is slightly changed. Glycogen and sugar are both increased.

The glycolytic and amylolytic ferments are said to be diminished.

It is very probable that there is some loss of complements, and that the hæmolytic and bactericidal properties of the blood are increased.

Iron and ammonia are present in larger amounts than usual.

The CO_2 content of the blood is low. This is probably due to the decrease in the oxidative processes arising from the "oxygen starvation" of the cells.

Of practical importance is the staining reaction of the blood. When diabetic blood is added to a weak solution of methylene blue, the blue is reduced to pale green (Williamson, Bremer). The reaction is more positive when acidosis is present. It cannot always be obtained, and it is apparent that the sugar is not the only factor concerned. When corpuscles obtained from diabetic blood are thoroughly washed, they will not stain with methylene blue, although the corpuscles of normal blood stain readily. The reaction also appears to vary at different times in the same cases, and does not evince any very definite relations to the variations of the glycæmia or glycosuria. Further observations upon this point are needed.

Lipæmia may be readily recognised; the opalescence of the blood appears immediately after it is withdrawn. The condition is more common than is generally recognised. It is due to an abnormal metabolism of tissue fat, and its presence means that the system is being compelled to use up its reserve of fat, and that the fat intake should be carefully increased.

Urine.—While it is only in special cases that a detailed examination of the blood is necessary, the urine in every case may be utilised for determining the requirements of the cells.

The attention, however, should not be directed too closely to the glycosuria.

Determinations of the total nitrogen, urea nitrogen, purin nitrogen, and residual nitrogen, yield valuable information in practised hands.

Estimations of the endogenous creatinin in diabetes are sorely needed.

The amino-acids of diabetic urines are, as yet, practically untouched. A few figures are to hand, but they only serve to indicate the need for further investigation into this important part of the metabolism in diabetes.

Additional observations upon the albuminuria, and upon the presence of the so-called "coma casts" might explain the relation of these bodies to the onset of the acidosis. Much work is still necessary to account for the increase of glycuronic acid in diabetic urines.

The part played by lactic acid, in the intermediate metabolism of carbohydrates, is an important one. In some cases, the administration of lactic acid has been followed by increased glycosuria; in others, the glycosuria has decreased. Further investigations are necessary.

It is of importance that the balance of the mineral substances in diabetics should be determined. We are still in the dark as to the exact mode of demineralisation in acidosis especially with regard to magnesium, potassium, and calcium; considerable advances in therapy would attend any increase in our knowledge of this branch of the subject.

For practical purposes, however, the practitioner of to-day must limit his clinical examination to the glycosuria and the acetonuria. Fortunately, it is possible from these alone to obtain considerable aid in treatment, especially when the urine examined is taken from the mixed 24 hours' urine, and the total quantity is known. It is perhaps unnecessary to point out that estimations of odd samples of urine by some "approximate" apparatus may lead to errors. The total daily output of sugar should be ascertained by trustworthy titrimetric methods, and the input controlled as closely as possible. In no other condition, perhaps, does careful estimation count for more than it does in diabetes.

For such estimations, it is an advantage to use a standard test diet such as that suggested by v. Noorden :—

Breakfast.—Coffee or tea with 1–2 tablespoonfuls of thick cream, 6 oz.
Hot or cold meat (weighed after cooking), 3 oz.
Butter.
Two eggs with bacon.
White bread, 2 oz.
Lunch.—Two eggs (cooked as desired but without flour).
Meat, about 6 oz.
Vegetables, such as spinach, cabbage, cauliflower, asparagus, prepared with broth, butter or other fat, eggs or cream, but without flour.
Cheese and butter, 1 oz.
Two glasses of light wine.
One cup coffee with 1–2 tablespoonfuls of thick cream.
White bread, 2 ozs.
Dinner.—Clear meat soup (with eggs or vegetables).
One or two meat dishes with vegetables, salad of lettuce and tomatoes.
Wine.
No bread.
Drinks.—One or two bottles of aërated waters.

If these 100 grammes of bread do not cause any glycosuria, then the bread is gradually increased until sugar appears. If sugar does appear with this test diet, then the diet may be continued for a few days until the sugar is constant, and the bread then diminished. Later, the effects of exercise, other sugars, other foods, particularly the albumins—amount as well as type—and the influence of medicines, can all be determined in accordance with the rules laid down by von Noorden and others (*see* Literature).

In addition to the better known methods, the following process, proposed by Ivar Bang, offers such manifest advantages that it may be worth while to describe it in detail. The errors, due to the reducing powers of creatinin and uric acid, are so small as to be negligible.

SOLUTIONS REQUIRED.

Copper Sulphate Solution.

Potassium carbonate	500 gm.
„ sulphocyanide	400 „
„ bicarbonate	100 „

Dissolve with heat in 1,200 cc. of water.

Cool and add a solution of 25 gm. of copper sulphate in 150 cc. of water.

Add water up to 2 litres.

Hydroxylamine Solution.

Hydroxylamine sulphate	6·55 gm.
Potassium sulphocyanide	200 „

Dissolve in water and make up to 2 litres.

Both solutions keep well. 1 cc. of hydroxylamine solution decolourises 1 cc. of the copper sulphate solution.

1. Place 10 cc. of urine in a 200 cc. flask.
2. Add 50 cc. of the copper sulphate solution.
3. Boil for three minutes. The solution must remain blue. If it is reduced, commence again, using diluted urine, and make the necessary calculations later. When the urine contains more than 3 per cent. of sugar dilution is necessary.
4. Cool under water-tap.
5. Run in hydroxylamine solution until the blue disappears.
6. Note the number of cc. of hydroxylamine, and read off the quantity of sugar in the 10 cc. of urine from the table on p. 29.

Repeated estimations upon the excretions of the same patient, under similar and under different conditions, yield factors which form a guide to the capacity of the individual for carbohydrates. In other words, a knowledge is obtained of the assimilative powers of the cells for one or more carbohydrates.

This utilisation power has been termed "tolerance," and the "tolerance" of the diabetic for carbohydrates furnishes the key to the problems of treatment for the individual phase and extent of the condition. The "tolerance" may be raised, and maintained at its highest level by the information obtained concerning the type and daily variations of the glycosuria and acetonuria of the patient.

TABLE OF EQUIVALENTS FOR THE HYDROXYLAMINE SOLUTIONS.

Hydroxylamine Solution.	Sugar.	Hydroxylamine Solution.	Sugar.	Hydroxylamine Solution.	Sugar.
cc.	mgm.	cc.	mgm.	cc.	mgm.
44	4·9	29	19·6	14	37·7
43	5·8	28	20·7	13	39·0
42	6·7	27	21·8	12	40·4
41	7·6	26	23·0	11	41·8
40	8·5	25	24·1	10	43·3
39	9·4	24	25·2	9	44·7
38	10·4	23	26·5	8	46·3
37	11·4	22	27·7	7	48·0
36	12·4	21	29·0	6	49·8
35	13·4	20	30·2	5	51·6
34	14·4	19	31·4	4	53·4
33	15·4	18	32·6	3	55·0
32	16·5	17	33·9	2	57·3
31	17·5	16	35·1	1	59·4
30	18·6	15	36·4		

This "tolerance" factor therefore furnishes the means of regulating the dietary and the life of the patient. Haphazard instructions go by the board. The diabetic is given a specially ascertained opinion, and, if he does not utilise it, he should be instructed as to the risks he thereby runs.

It will be obvious that the main object in the management of this metabolic anomaly is to raise the carbohydrate capacities of the cells of the tissues by the use of those previously cited conditions, which increase the utilisation of the fed carbohydrates, diminish the amount of unused sugar, and decrease the acetonuria and the acidosis.

But it must be remembered that *variations in the intensity* *of the glycosuria* may arise from such complications as severe injuries, inflammatory skin diseases, furunculosis, and gangrene. The need for the repeated determination of the "tolerance" capacity of the individual is emphasised by the fact that acute febrile disorders, especially influenza and streptococcal infections, leave behind them temporary exacerbations of the diabetes, which may become persistent.

The following classification by von Noorden and Naunyn may be found useful for the interpretation of the "tolerance" factor :—

1. *Slight Glycosuria.*—The urine may contain sugar when starchy foods are taken by the mouth. Some cases can tolerate 50, 100, or 150 grammes of starch per day, without developing glycosuria, but excrete sugar with an intake of 200 grammes.

2. *Medium Glycosuria.*—Under this heading are placed those cases in which, in addition to the carbohydrate restriction, the proteins must be limited so that the total nitrogen output lies between 10 and 18 grammes per day.

3. *Severe Glycosuria.*—This group includes those cases which, in the absence of carbohydrate food, the glycosuria continues, unless the protein intake is reduced so as to keep the urinary nitrogen well under 10 grammes per day.

With regard to the ketonuria, diabetic patients exhibit such remarkable changes from the ketonuria of non-diabetics, that it may be worth while to append the following conclusions of von Noorden :—

1. Some diabetic patients are able to tolerate 70–100 gms. of carbohydrate per day, and yet excrete large quantities of acetone.

2. Many diabetics develop ketonuria when transferred from a mixed diet to one free from carbohydrate, and the acetone does not disappear when carbohydrate is again given. An unfavourable prognosis must be given in these cases.

3. In other cases the ketonuria, resulting from a strict diet, is temporary or absent, or falls after an initial rise. The removal of all carbohydrates appears to improve the general condition, and alleviates the pathological condition which produces the ketonuria.

4. At different periods of the disease—even when the diet and carbohydrate tolerance are constant—the ketonuria may

show wide variations, which at present cannot be adequately explained.

5. Different patients, with similar tolerance factors, and upon the same diet, exhibit different degrees of ketonuria.

In the two last groups, it is probable that something more than personal idiosyncrasy is at work.

The variations must arise from differences in the extent of the inefficient oxidation, of the deficient formation of carbohydrate from fat, and of the defect in the power to form and retain glycogen from carbohydrate, which prevail in the individual cases of diabetes.

More work has been done upon the metabolism in diabetes than upon that of any other disease, and yet we are only just beginning to realise the vastness of the "inner circle" of the metabolic changes. It is fortunate, however, that the observations already recorded are such that their careful application ensures for the diabetic patient a more comfortable, as well as a prolonged existence.

RECENT LITERATURE.

The writer wishes to express his indebtedness to the following works of reference which have been freely used for the purposes of the paper :—

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DIET IN DIABETES.

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CLASSIFICATION OF THE DIABETIC PATIENTS.

My observations upon nutrition in diabetes[1] have led me to divide the cases into two main classes.

1. *Diabetes without Loss of Nutrition.*—These cases are by far the more frequent, and correspond to the fat diabetics of the older writers—the arthritic diabetics of the text-books.

2. *Diabetes with Loss of Nutrition.*—These are rarer, and the condition assumes in them a much more serious character. They are the wasted diabetics of the older writers—the pancreatic diabetics of the text-books.

In cases belonging to the first category, *without loss of nutrition*, the nitrogenous balance is maintained. The physiological disorder only concerns the intra-organic metabolism of the carbohydrates of the food, which are not assimilated as they are under normal conditions. However, the patients are still capable of making use of a certain amount: they possess a *relative tolerance.* Glycosuria is only produced when the patient takes a quantity of carbohydrate greater than his tolerance: the sugar *originates from the carbohydrates of the food.*

Diet is the ruling factor in the evolution of these cases of diabetes, and, by its means, we can at will cause the appearance or disappearance of sugar in the urine and other symptoms of diabetes.[2] The effect produced by diet is explained by the retention and the accumulation of sugar in the patient's system. When given a *hyperglucosic diet,* that is to say, one greater than his tolerance, the patient retains part of the carbohydrates, which escape assimilation, and eliminates the remainder by glycosuria. In this way is produced, by degrees, a condition of *hyperglycistia* and of *hyperglycœmia,* upon which depend the symptoms and complications of diabetes. Hyperglycistia is the danger, and treatment ought to compel the system to eliminate the harmful reserves of sugar; this is accomplished by dieting. When a patient is given a *hypoglucosic diet*, that is to say, one lower than his tolerance, he is compelled to use up and to expel his accumulated reserves of sugar. I have shown by clinical observations[3] that, when undergoing treatment by hypoglucosic diet, the diabetic eliminates as much sugar as he had retained during the period of hyperglucosic diet. Finally, when placed upon an *isoglucosic diet*, that is to say, one equal to his tolerance, the patient is able to live indefinitely without showing either glycosuria, or the other symptoms or complications usually met with in diabetes. To sum up, the danger is hyperglucosic diet leading to hyperglycistia; the object of treatment is the expulsion of the retained sugar; and the means hypoglucosic diet.

In cases belonging to the second category, *i.e., those with loss of nutrition,* the nitrogenous balance is upset, the tissues are destroyed, the patient undergoes waste of nitrogen, and loses flesh. He is unable to tolerate even the smallest amount of carbohydrate, all that he may ingest being excreted as sugar. When carbohydrates are absolutely excluded from the diet, glycosuria continues, nevertheless, for the patient is incapable of assimilating even the carbohydrates, which result from the metabolism of the albumins and fats included in his food, or provided by destruction of his tissues. This glycosuria, always in very large amount, has a complex origin. It is derived both from the *food* and from the *tissues*, and comes from the *carbohydrates, albumins, and fats.*

In such a case, the danger threatening the patient is threefold, arising from hyperglycistia, as in cases belonging to the first category, from loss of nitrogenous nutrition, and from the acidæmia, which is the result of the intoxication of the system by the products derived from the albumins of the tissues and the albumins of the food. Dieting still forms the means by which to ward off the dangers confronting the patient, though the difficulty is that the indications are so contradictory. Hyperglycistia calls for reduction of carbohydrates, nitrogenous denutrition requires abundant intake of albuminoid matters; but acidæmia is produced by excessive meat diet, and on that account must be fought by vegetarian diet. Of two evils the less must be chosen; the danger of hyperglycistia being less serious than that of acidæmia, excessive use of albumins must be avoided, and the patient must not be deprived of carbohydrates; the diet must be plentiful and mixed.

Whatever may be the ætiology, or the anatomical lesion, which has brought about the condition, every case of diabetes belongs to one or other of these two categories; only a few rare examples escape them and form an intermediate group. In these cases of *diabetes with moderate loss of nutrition*, the patient possesses a relative tolerance for carbohydrates, but he has slight nitrogenous waste, and his glycosuria is partly derived from the transformation of albuminoid matters. The indications for treatment, in such a case, are contributed to by both classes, viz., with and without loss of nutrition.

Examination of a Diabetic Patient.—The conclusion to be drawn from these statements is to the effect that a dietary can only be properly drawn up for a patient after a thorough examination, allowing us to determine his assimilative capacity, and to classify him in one or other of the categories established. A superficial clinical examination, with the sole idea of finding out the amount of sugar excreted, is not enough; a comparison of the intake of carbohydrates with the output of sugar is necessary in order to classify the case. Such a comparison is very easily obtained. The first day on which the patient comes for advice, observation should begin, without as yet changing anything in his diet, by directing him to weigh separately each article of food he eats and to collect the whole of the urine passed, during the space of twenty-four hours. From the food is then calculated the amount of carbohydrates ingested, and from the urine the quantity of sugar excreted; the comparison of these two results shows whether the patient has a tolerance for carbohydrates, and what is the approximate value of that tolerance. The difference between the total amount of carbohydrates ingested and that of the sugar excreted gives the *apparent tolerance*.

For example, in one case, the details of which I have published, the patient on the first day showed 16 g. of sugar in the urine corresponding to an intake of 60 g. of carbohydrates. He was, therefore, excreting less sugar than he took in, and was placed in the first category; his apparent tolerance being 60 – 16 = 44 g. On the other hand, another patient was excreting 639 g. of sugar for an ingestion of 422 g.

of carbohydrates. He belongs, consequently, to the second category—diabetes with loss of nutrition—and was excreting more sugar than he took in ; his glycosuria was not entirely due to carbohydrates, but to the albumins and fats of the foods and the tissues as well.

This much simplified analysis of the patient's nutrition suffices for classifying the majority of cases. In difficult cases, however, it is necessary to resort to a full investigation of the nutrition, based upon the comparison of the food-intake with the urine and fæces.

DIETING.

(i) *Diabetes without Loss of Nutrition.*—The treatment consists of two successive phases. In the first place, *the cure of hyperglycæmia.* When a diabetic patient has been brought by improper diet to a condition of hyperglycæmia, it is necessary to rid the system of the sugar accumulated therein, by putting him on a diet containing a reduced amount of carbohydrates, lower than his tolerance. It is very much better not to reduce the diet too abruptly, but to proceed gradually, for, in this way, the glycosuria disappears more slowly but more surely. For example, in one of my patients, who at the outset was passing 300 g. of sugar in his urine for a carbohydrate intake of 320 g., I reduced the carbohydrate gradually to 211 g., then to 137 g., eight days later to 117 g., after another eight days to 110 g., three days later to 98 g., and forty days afterwards to 51 g. At the end of two months, I finally obtained cessation of the glycosuria, the patient had put on flesh, and the diet had been well borne ; but this would not have been the case had I been desirous of proceeding too abruptly with the reduction.

Then follows the *diet of tolerance.* When the stage of sugar-free urine has been reached by means of the foregoing treatment, it is necessary to prevent the re-appearance of the hyperglycæmia by instituting a carbohydrate diet, which is lower than, or at most equal to, the patient's tolerance. The actual tolerance is determined in the following way :—As soon as the urine becomes sugar-free, the amount of carbohydrates is gradually increased until sugar again appears, whereupon the amount is once more reduced until the glycosuria disappears. The actual degree of tolerance for carbohydrates, lies between the last two amounts tried, that which causes, and that which does not cause, sugar to appear in the urine. Thus, in the patient mentioned before, I was able to estimate his tolerance at 150 g., and for a year and a half it showed no variation. As the tolerance remains stationary for almost an indefinite period, barring complications, it is enough to keep the patient upon a diet slightly lower than his tolerance, in order to prevent the reproduction of symptoms of hyperglycæmia.

The dietary I prescribe to a diabetic patient consists of four parts:—

1. The fundamental carbohydrate.
2. The accessory carbohydrates.
3. The albuminous, fatty, and alcoholic foods.
4. The forbidden foods.

The *fundamental carbohydrate food* is most frequently the potato; the amount allowed *must be exactly prescribed by weight*, and never left to the patient's caprice. He is not placed upon a diet of potatoes, but he is allowed 100, 400, or 800 g. of potatoes, according to the nature of his case. During the stage of sugar-reduction, the quantity of fundamental carbohydrates should be one half or one quarter of the conjectured tolerance. In the diet of tolerance, the quantity should be about 10 g. below the patient's tolerance. The calculation of the amount of potatoes to be allowed is easily made, thanks to the tables of the composition of foods worked out by Koenig, Atwater, or Alquié. For instance, to a patient with a tolerance of 100 g. I will allow 90 g. of potato-starch, and noting that the tuber contains on an average 20 per cent. of starch, I shall order 450 g. of potatoes a day. The food is weighed uncooked, and prepared to the taste of the patient; all the cookery recipes are good, provided that they do not entail the use of starch or sugar.

This fundamental carbohydrate is served up as an adjunct to other dishes, taking the place of bread, which, as a rule, I prohibit, because of the inferior utilisation of its starch, and of the difficulty in allowancing it. Diabetic patients, often great bread-eaters, more willingly accept deprivation of it than a reduction in consumption. I do not care to prescribe the special diabetic breads, like gluten bread, aleuron bread, or almond bread, because their contents in starch vary very much according to their production. Some of them contain more than 40 per cent., and offer hardly any advantage over ordinary bread; others only contain 20 per cent., but they have a horrible flavour, and keep very badly, so that patients do not like them. Almond breads are very greasy and indigestible. The special breads, so-called "anti-diabetic," have, moreover, a very great drawback, arising from the fact that patients, on the strength of the advertisements, attribute to them a curative effect, and believe that they can eat them without stint. Another idea, frequently met with, concerns the crust of bread, which many diabetic patients believe they ought to eat rather than the crumb; now, weight for weight, the crust contains more starch than the crumb.

The fundamental carbohydrate can be varied. When potatoes have been given for one or several weeks, it is an advantage to replace them by another but similar food. This breaks the monotony of the diet, and pleases the patient. The new food must be allowed in such quantity that the authorised amount of carbohydrate remains the same. If, for instance, we wish to replace 450 g. of potatoes by an isoglucosic amount of rice, which contains 79 per cent. of starch, we must order 112 g. of rice a day. A table showing the quantity of different foods able to provide 100 g. of carbohydrates, allows the changes to be made quite easily.

100 g. of carbohydrates are provided by :—

Potatoes - - - -	500 g.
Bread - - - -	190 g.
Dry peas - - - -	170 g.
Rice - - - -	112 g., etc.

The choice of the fundamental carbohydrate depends upon the taste of the patient, the adaptability of the food to the purposes of cookery, and especially upon the degree of tolerance exhibited by the patient's system in respect thereto. The different carbohydrates are not, as a matter of fact, assimilated in the same way by diabetic patients; some are better utilised, and produce, for equal weights, less glycosuria. A large number of comparative observations, carried out on cases of diabetes, has enabled me to fix a scale of tolerance for the usual starchy foods; they are arranged in the following order:—potato, oatmeal, macaroni, chestnuts, rice, haricot beans, lentils, peas, milk, bread, sugar.[4]

In practice, the most useful are: potatoes, dried vegetables containing a large amount of albumen, rice, and food-pastes; all of which are well tolerated by the digestive organs, and lend themselves to the preparation of a great variety of dishes. Milk does not possess the qualities attributed to it by Donkin, the sugar is rather poorly utilised. Nothing is gained by ordering an absolute milk diet, except in the case of patients suffering from serious digestive troubles, or from retention of chlorides; in fact, such a diet may be dangerous for patients having low tolerance, because it always contains a rather large proportion of sugar.

The *accessory carbohydrates* are required to make up for the loss of bread, and to be eaten with meat. They are provided by green vegetables and salads, chicory, sorrel, spinach, cooked salads, cabbage, Brussels sprouts, cauliflower, sour-kraut, asparagus, celery, egg-plant, cucumber, endive, leek, tomato, and radish. They contain but a very small proportion of carbohydrates, and may be allowed to the extent of 300 g. a day, or even *ad libitum;* this amount does not supply the organism with more than a dozen grammes of carbohydrates. Cooked green vegetables are of even greater advantage than raw salads, because the cooking in water makes them lose an appreciable amount of carbohydrates.

The *albuminous, fatty, and alcoholic foods* should supply the system with the calories required for its maintenance, since the carbohydrates, being assimilated only in small quantities, do not share in heat-production beyond a very limited extent. It is well to point out exactly the quantity of these foods which the diet should contain, for the reason that patients, with loss of appetite, will be insufficiently nourished, while others, big eaters, will have a tendency to take too much nourishment. The danger of an excessive meat diet arises from the acidifying effect of albumins upon the system, and leads the patient on to acidæmia and coma. It does not proceed from the over-production of sugar, because in patients, without loss of nutrition, glycosuria does not appear to be derived from either the albumins or the fats of the food. Fats, which have a high caloric yield, and offer the minimum of harm, must be introduced into the diet of diabetes in large quantities. Incorporated with green vegetables, or with potatoes, they are well borne.

I prescribe this diet in the following way :—

Meat (butcher's, poultry, fish, and "charcuterie"), 200 to 500 g. (½ to 1 lb.).
Eggs, 2 to 6.
Cheese, Gruyère, Dutch, Gervais, etc., 50 to 100 g. (1½ oz. to ¼ lb.).
Butter, 50 to 100 g. (1½ oz. to ¼ lb.); fresh cream; olive oil.
Wine (not sweet), ¼ to ½ litre (½ to 1 pint).

The *prohibited foods* are all carbohydrate foods, except those specified above. These are: ordinary bread and diabetic breads, cakes of sorts, biscuits, pastry, dried vegetables, food-pastes, rice, chestnuts, the various farinas, chocolate, sugar, sweetmeats, jams, fruits, milk, sweet wines, cider, beer, and syrups.

In its main features, the diet resembles the classical diet of Bouchardat, but differs altogether in the one essential point, the way in which the prescriptions are drawn up. The principle of it is to take into account not only the quality but the quantity of the foods. It is much easier, when dealing with undisciplined patients like diabetic cases, to make them obey than it is to appeal to their reason. Nothing must be left to their initiative, and that is why I order a patient an amount of food—albuminous, fatty, and carbohydrate—in harmony with his tolerance and his systemic necessities, and forbid him to take anything outside my prescriptions.

It is well to point out to the patient in what way he can arrange his meals, for the dietary allows of fairly varied menus. I give an example, which supplies the body with 2,000 calories, without reckoning the calories which would result from the complete assimilation of the fundamental carbohydrates: 200 g. of potatoes would be able to provide 160 calories in addition.

Early Breakfast :—Black coffee without sugar, 150 g. (6 oz.) ; cream, 50 g. (2 oz.).

Mid-day Meal :—

1. Two eggs (fried, buttered, in omelet, etc.), cooked with 40 g. (1½ oz.) of ham or 30 g. (1 oz.) of bacon ; 10 g. (⅓ oz.) of butter.
2. Meat (grilled or roasted, hot or cold), 150 g. (6 oz.), cooked with 15 g. (½ oz.) of butter ; *or*, fish, lobster, or kipper, 150 g., with 15 g. of butter or mayonnaise.
3. Vegetables (green), spinach, asparagus, cabbage, etc., 150 g. (6 oz.), cooked with 10 g. (⅓ oz.) of butter ; *or*, 150 g. of fresh salad with oil and vinegar ; *or*, 100 g. of radishes, long or short, with 10 g. (⅓ oz.) of butter.
4. Cheese (Gruyère, Brie, Cheshire, etc.), 20 g. (⅔ oz.), with 10 g. (⅓ oz.) of butter ; *or*, 40 g. (1½ oz.) of cream cheese.
5. Potatoes, 100 g. (3½ oz.).
6. Beverage, 1 glass of red wine, 1 litre (2 pints) of water, 100 g. (3½ oz.) of black coffee.

Five o'clock Tea :—

1 cup of tea, 150 g. (6 oz.), with 20 g. (⅔ oz.) of ham or potted meat.

Dinner, 7 p.m. :—

1. Soup :—Bouillon 300 g. (½ pint), or onion soup (strained).
2. Hors d'œuvre :—Sardine, herring, or tunny, 20 g. (⅔ oz.), with 10 g. (⅓ oz.) of butter.
3. Meat, 100 g. (3½ oz.), with 20 g. (⅔ oz.) of butter.
4. Salad (fresh), 100 g. (3½ oz.), with oil and vinegar.
5. Cheese, 10 g. (⅓ oz.), with 5 g. (½ oz.) of butter ; *or*, 15 g. (½ oz.) of Gervais cheese ; *or*, 15 g. (½ oz.) of vanilla or coffee cream.
6. Potatoes, 100 g. (3½ oz.).
7. Wine, 1 glassful ; camomile or lime tea.

(ii.) *Diabetes with Loss of Nutrition.*—The dietary must be mixed ; it will be composed of albumins, in order to ward off loss of nutrition, of fats to supply calories, and of carbohydrates to keep the system alkaline ; plentiful, so as to prevent wasting, and satisfying to the polyphagia present in this class of case. The choice of foods must be made from those already mentioned.

Von Noorden, a few years ago, extolled oatmeal, and his experiences, with those of Lüthje and of Friedenwald and Ruhrah, have shown that, though oatmeal exhibits a quasi-specific action in some cases of grave diabetes, it does not offer any great advantages in mild cases. It stops glycosuria, and, at the same time, acetonæmia and wasting in patients, whose general condition has been made very bad by a strict meat diet. Von Noorden gives 200 to 250 g. of oatmeal a day, and orders it to be taken in the form of porridge, each portion being made with 40 to 50 g. of meal, 20 to 40 g. of butter, and 1 or 2 eggs.

Unfortunately, this diet only suits a small number of patients; it is not well borne, as a rule, and gives rise to colic and diarrhœa. I have made a trial of it in two cases with loss of nutrition; in one, from the first day, symptoms of indigestion were produced, and were renewed three weeks later when a second attempt was made. The other case bore it for six days, but no noticeable improvement was brought about. Lipetz, even in grave cases, has not obtained any good effects from the oatmeal treatment. Before investigating how and why oatmeal cures diabetes, it would be better to obtain many more observations, in order to see if the successes are not simply due to happy coincidences.

It is evident that the diet, which has a powerful and positively curative effect upon diabetes without loss of nutrition, is most frequently of none effect in the case of diabetes with loss of nutrition.

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ON THE HEART IN RELATION TO DIABETES.

By Sir LAUDER BRUNTON, M.D., LL.D., F.R.C.P., F.R.S., &c.,
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To give an exact description of the heart in diabetes is at present extremely difficult, almost impossible. We may understand the difficulty that surrounds this subject, if we consider what the result would be if any one attempted to describe the condition of the heart in patients suffering from cough. The cause of the cough might be simply a little laryngeal, or bronchial catarrh, and the heart would be found perfectly normal. In other cases, in which the cough depended upon emphysema, or chronic cardiac disease, the heart might be greatly dilated, or hypertrophied, and, in cases of chronic phthisis, it might be somewhat atrophied. The results of post-mortem examinations would thus be so contradictory as to be absolutely valueless. The same difficulties occur in an attempt to give an account of the condition of the heart in diabetes, because the term diabetes is very often used to include all cases in which sugar appears freely in the urine. But the appearance of sugar in the urine, or glycosuria, is not a disease, like cough it is merely a symptom. It may be produced experimentally by alterations in several entirely different organs, viz., the liver, the pancreas, or the kidneys.

Hepatic glycosuria from alteration in the liver, or in the circulation through it, occurs after puncture of the fourth ventricle, as in Claude Bernard's well-known experiment, after many nervous lesions, and from the administration of various poisons. Pancreatic glycosuria may be produced by an obstruction of the pancreatic duct. Renal glycosuria appears after the administration of phloridzine.

It is probable that the causation of glycosuria in patients is quite as complex as, or even more complex than, that which can be produced experimentally, and yet cases of glycosuria, until within quite a recent period, have all been classed as diabetes. It is this that makes it so difficult to write on the condition of the heart in diabetes.

Glycosuria sometimes persists for a very long period indeed without producing any marked effect on the patient. I have had under observation, at intervals, for nearly thirty years, a patient, whom I first saw for glycosuria in 1879. For two years previously, he had been troubled with intermittent pulse, but this condition subsided, and although he has had glycosuria ever since, from time to time, when I last saw him a few months ago his urine was quite free from sugar, and his heart and circulation quite normal, with the exception perhaps of a little accentuation of the second sound over the aortic valves. His ailment I regard, not as diabetes, but as gouty glycosuria.

Gouty glycosuria is, I think, just as different from true diabetes as bronchial catarrh is from phthisis. True diabetes, as a rule, occurs early in life, and runs a rapid course, whereas gouty glycosuria usually occurs after middle age, and may persist for many years without apparently doing the patient any harm.

In the progress of such cases, however, the glycosuria not infrequently becomes less marked, or disappears altogether, and other gouty conditions become prominent, more especially arterio-sclerosis, gouty kidney, cardiac hypertrophy, and other consequences. It is obvious then that to look for anything like uniformity in the post-mortem conditions occurring in cases, in which sugar has been present in quantity in the urine during life, would be as absurd as to look for uniformity in post-mortem conditions in persons who had suffered from cough. It is probably on account of the absence of uniformity in their results, that Professor Seegen, after examining thirty-two cases of diabetes, on which autopsies has been made in Vienna by Rokitansky, between the years 1838 and 1870, mentions the condition of many other organs, but entirely passes over that of the heart and arteries. Other authors are almost equally unsatisfactory, and the best account, that I can find of the changes in the circulatory apparatus, is given by von Noorden. Here again the difficulty arises that the post-mortem conditions he records were probably due, in many cases, to gout, or to some other complication rather than to the diabetes itself. Thus atrophy, with fatty infiltration and dilatation, is found in some cases, but the atrophy occurs oftenest in those, whose condition is deteriorated, and especially in those, in which diabetes has been complicated with tubercle. The fatty condition of the heart was not infrequently due to sclerosis of the coronary arteries. Cardiac hypertrophy has been found in proportions varying from 10 to 13 per cent., but in these cases there were generally alterations in the kidney as well.

In true diabetes, the cardiac affections most likely to occur are those which depend upon impairment of the nutrition of the muscular fibre, or of the nerves of the heart by the presence of sugar in the blood, or by other metabolic changes coincident with this excess of sugar. One of the commonest symptoms of diabetes is weakness of the muscles in the limbs and disturbance in peripheral nerves, either of their sensory or motor functions, or of both. What occurs in the limbs we would expect also to find in the heart, and this is actually the case.

In young patients, in whom diabetes is not complicated with other diseases, the muscular tissue of the heart is frequently found, on post-mortem examination, to be flabby or atrophied. During life, the circulatory symptoms are such as we would expect. They are shortness of breath on exertion, and frequently irregularity or palpitation on exertion or excitement, or after too free indulgence in the pleasures of the table, in alcohol or tobacco.

From the weakness of the cardiac muscle, any over exertion is apt to produce dilatation more easily in such patients than in healthy people, and they recover from its effects much more slowly. The pulse rate is very readily quickened to an extraordinary extent by any excitement of body or mind. Not infrequently the patients complain of attacks of faintness, or of oppression, or pain amounting to angina pectoris.

These symptoms may be in part due to the presence of sugar, and to the general alteration in metabolism, which leads to glycosuria, but they may also be the consequences of an original nervous condition, which gave rise both to these symptoms and to the glycosuria. In 1875, I recorded a case of glycosuria in the *St. Bartholomew's Hospital Reports*, in which exophthalmic goitre existed at the same time. In this case there was tachycardia, with cardiac dilatation, and a certain amount of mitral regurgitation. The case was remarkable for the sudden death of the patient without any apparent cause, and no valvular disease of the heart was found after death. In this case there had been no increased exertion preceding death, and only a little emotional disturbance. Sudden death has, however, not infrequently been noted in cases of diabetes, not only after emotional disturbance, but after unusual exertion, such as mountain climbing or a long journey.

In the case which I described there was, as I have already said, no valvular lesion whatever, although there was a marked regurgitant mitral murmur during life, which was probably due to cardiac dilatation.

Endocarditis may occur in patients suffering from diabetes, as well as in others, and may lead to valvular changes, but it does not seem much, if at all, more frequent in diabetics than others. Of course the coincidence of glycosuria with valvular disease is unfavourable. In mitral disease, occurring in diabetics, dropsy is less common than in others, probably because the sugar acts as a constant diuretic. In cases of glycosuria, occurring in persons after middle age, although the symptoms already mentioned may occur, yet attention should be carefully directed more especially to the occurrence of arterio-sclerosis, increased arterial tension, and all the consequences to which it is likely to give rise. On post-mortem examination, the heart may be found much hypertrophied, and the vessels atheromatous, and the kidneys sometimes showing marked granular atrophy. In cases of glycosuria, in persons above middle age, the urine should always be examined carefully for minute traces of albumen. These are sometimes so slight that it is almost impossible to detect them, except by acidulating freely with acetic acid, and boiling in a test tube the upper part of the urine only, so that the lower part remains as a control. By then examining the tube against a dark background, a faint haze may be seen, and this may generally be rendered more visible by the subsequent addition of picric acid. In many such cases, the sugar readily disappears from the urine, under proper diet and treatment, and the case becomes one of ordinary gouty kidney.

To sum up, shortly, our knowledge of the condition of the heart in diabetes, we may say that in young diabetics there is a tendency to malnutrition of the cardiac muscle and the cardiac nerves, leading to functional disturbance and possibly to sudden death. There seems also to be a tendency for the appearance of atheromatous change in the vessels generally, and in the coronary arteries especially, at a somewhat early age leading to fatty degeneration, feebleness of the heart, and angina pectoris. In gouty glycosurics, while the excessive sugar in the blood is injurious to the nutrition of the heart, the risk, which is chiefly to be feared, is from alterations in the peripheral vessels leading to high tension, and cardiac hypertrophy with subsequent failure, or to rupture of a vessel and apoplexy.

In regard to the treatment of cardiac disease in young diabetics, the most important point is to lessen the sugar in the blood by appropriate diet; at the same time, it must be remembered that the large amount of water, excreted by the kidneys under the stimulus of the sugar, is apt to carry with it a large amount of inorganic salts, and thus impoverish the organism of its inorganic materials. Especially is this to be remembered in regard to salts of calcium, which have a most important action as cardiac nutrients, and the administration of calcium phosphate, or lacto-phosphate should not be omitted in any case of tachycardia, palpitation, or cardiac weakness and dilatation occurring in patients with diabetes uncomplicated by gout. In such cases, a proteid diet with a minimum of carbohydrates is indicated; cardiac tonics, such as digitalis or strophanthus and codeine, or morphine, which tend to lessen the production of sugar, may all be useful. In cases of gouty glycosuria, the dietary is more difficult, because, on the one hand, carbohydrates are to be avoided as they increase the sugar, and, on the other, albuminous matters should be restricted on account of albuminuria and renal inadequacy, while even fats have been objected to as producing an increased tendency to so-called acetonuria. In such a condition, one is obliged to make milk the staple article of food, and to add to it albuminous foods as free from purin bodies as possible. In many cases, however, one must allow fats as well as small quantities of farinaceous foods, so as to maintain the patient's strength.

The use of digitalis has been objected to by Schott in cases of cardiac disease occurring in diabetics, while von Noorden finds it very serviceable. The reason for this discrepancy of opinion, I believe to be that, while digitalis is useful in a case of diabetes without gouty complications, it requires to be used with great care in cases of gouty glycosuria, in which the heart is hypertrophied, and the arterial tension already too high. In such cases, the tendency of digitalis and strophanthus to still further increase the tension, should be counteracted by the administration, at the same time, of nitrite of soda, tri-nitrine or nitro-erythrite. A combination of salicylate of soda, or some of the other salicyl derivatives with codeine, is, I think, sometimes serviceable.

THE CARLSBAD TREATMENT OF DIABETES AND GLYCOSURIA.

By Dr. FREDERICK KRAUS,
Carlsbad.

In spite of the great work which has been done during the last decades by such prominent men as Naunyn, v. Noorden, Pavy, Lepine, Minkowsky, Seegen, and others, and which has increased our knowledge of diabetes, we are still without any unanimously accepted theory as to the cause and seat of this morbid condition, and are, therefore, limited to a purely symptomatic treatment. The treatment of diabetes at Carlsbad is likewise bound to be symptomatic, and its object will be the glycæmia, the consequent glycosuria, and all those symptoms, which we are accustomed to consider in connection with it. And as Naunyn says, "If we can do something in that line, we already do a great deal." I may, therefore, perhaps, be permitted to briefly describe the treatment of diabetes, *sensu strictiori*, and glycosuria together. We know that we can rarely say at the outset whether, in a concrete case, a glycosuria will remain a simple glycosuria with a relatively favourable prognosis, or whether an apparently harmless glycosuria will not turn into diabetes, which happens under the influence of acute infectious diseases, as, for instance, after influenza, or consecutive to a trauma or a mental shock. For that reason, it is advisable to treat also cases of mild glycosuria according to the principles and rules to be observed in diabetes. But we shall try to persuade the patient, so far as possible, that his case is a mild one, provided that he will strictly observe our *régime* and treatment, because we know how detrimentally nervous excitement and anxiety act on the glycosuria.

The treatment of diabetes in Carlsbad can be divided into five parts :—

(*a*) The internal use of the waters ;
(*b*) The diet ;
(*c*) Baths ;

(*d*) The use of all those different therapeutic methods and proceedings, which we comprehend under the name of "physiologic therapy."

(*e*) Pharmaceutical treatment.

The internal use of the waters, combined with the diet—a point I wish to emphasise—is a determining factor. With reference to the therapeutic value, and the theoretical explanation of it, I shall say a few words presently, and will now pass on to describe the way, in which the waters are prescribed at Carlsbad. The only one universally valid law, so far as the internal use of them is concerned, is that, in every single case, the prescription must be accommodated to the idiosyncrasy of the individual. The usual period of a cure is 3—4 weeks. At the commencement the cooler springs are generally prescribed, Marktbrunn, Schlossbrunn, Kaiserbrunn, 2—3 glasses, each containing 210 gr. = 7 ozs., which are to be sipped in the morning, on an empty stomach, in 5—10 minutes, with an interval of 15 to 20 minutes between each. An exception is made in cases, with an inclination to diarrhœa, sensitive, or catarrhalic affected intestines, when the hot springs in smaller doses are given during the day, Felsenquelle, Franz Josefsquelle, Sprudel, 2—4 half glasses in the morning, 2 half glasses at noon an hour before lunch, and some time before supper (7—8 o'clock p.m.) the same quantity. When the doctor has found out, how the patient tolerates the water prescribed, the quantity is increased, but at the most not more than 5—6 glasses per diem are given. If the bowels act too freely, the quantity is not only not increased, but restricted, or the spring may be changed for one of the before-named hot ones.

An exceedingly old habit, still prevalent, is to take the waters in the morning, on an empty stomach, and the reason for it is easy to understand. An empty stomach and empty intestines absorb better than when full, and a walk in the fresh, clear morning air, acts beneficially on the appetite, the action of the bowels, and the general feeling of the patient. But also here exceptions have to be made. Delicate patients, who get headaches, if too long without breakfast, and feel low, are told to take the first glass in bed, the second while dressing, or, if necessary, before getting up, to take a small cup of tea or coffee with cream, and then, after at least one hour, to take the water either in the room, or at the spring.

If the patient gets constipated at the beginning of his course of waters, as sometimes happens by the change to a new and unaccustomed diet, he is advised to take a glass of cold Sprudel at bedtime, between 9.30 to 10.30 p.m., and if it does not produce the desired effect, a similar amount the first thing in the morning. In very obstinate cases, Carlsbad salt, which may be obtained in small packet of 10 grams at all the springs, will be added in the required quantity to the mineral water. In selecting the spring to be prescribed for the patient, we have also to consider the condition of his heart, of the vascular system, and of the blood pressure. At the smallest symptom of weakness of the heart-muscle, the quantity is reduced to a maximum of 3 glasses, generally less, per diem, and of water from a cool spring, with strongly derivating action on the intestines. Moreover, the patient will be told to avoid the dense crowds, gathered at drinking times round the springs, and to avoid also fatigue by the exercise usually taken during the drinking of the waters. In cases of arterio-sclerosis, a frequent complication of diabetes as well as of the gouty or fatty glycosuria, increasing the blood pressure by a sudden introduction of a large quantity of fluid into the system, must be avoided and one has to make use of the derivating action of the cooler springs, to relieve the vascular system by an increased excretion of fluid from the blood into the intestines. The same has to be said of cases complicated by chronic nephritis and increased blood pressure. On the other hand, a good "washing out," which means a large quantity of the waters, 5 to 6 glasses per diem, is advisable in those cases in which we have to deal with a catarrh of the bladder, or renal pelvis with a healthy parenchyma, caused by gravel, a combination which is seen not too rarely in cases of gouty glycosuria.

The dietetic treatment entirely follows modern principles. By a test-diet (standard-diet v. Noorden) with a fixed amount of carbohydrates, the power of assimilation is ascertained, increased by appropriate measures, and the eventually gained increase of the assimilating power measured, and stated by exact observation of the case. If the assimilating power cannot be increased, a diet has to be found out, which will prevent the patient from losing flesh, and postpone, so long as possible, the dangers of acidosis.

I generally use the following diet:—

Breakfast (to be taken as soon as good appetite is felt after finishing the last glass in the morning):
  Tea or coffee with thick cream.
  Bacon, or fat ham, and two eggs.
  1/2 Grahambread with plenty of butter.
Lunch (between 1 to 2 p.m.).
  Clear soup with beef-marrow.
  Boiled or broiled fish with fresh butter.
  Meat, game, poultry (fat meat like pork, or duck, or goose, in preference).
  Vegetables, which contain very little carbohydrates: spinach, French beans, cauliflower, cabbage, stewed lettuce, cucumber, etc., plainly boiled in salt-water or soup, with fresh butter.
  Green salad with lemon-juice and plenty of oil.
  1/2 Grahambread with butter and fat cheese (Gervais, Imperial).
4 to 5: cup of tea or coffee with cream.
Supper (7 to 8 p.m.).
  Fish, or hot or cold meat, or eggs. Hot vegetables with butter.
  1/2 Grahambread with butter and cheese.

Whisky and Bilin water to be taken at lunch and supper.

That diet contains about 80 grams of carbohydrates (150 gr. bread). The patient is now told, to observe that diet strictly for 2 to 4 days, and, on the last of these days, to collect 24 hours' urine, that is to say, he must begin with the portion, first passed after breakfast, and finish with the last before breakfast next morning. This means a certain amount of discomfort for the patient, but the majority of them willingly undergo it, if the importance of careful observation and exact analysis is made sufficiently clear to them. The quantity collected during the 24 hours gives exact information as to how much of the carbohydrates, introduced with the diet into the body, is made use of, and how much passes as waste in the urine.

Take a short example by way of illustration.

The patient passes, within 24 hours, 2,500 ccm. of urine with 2 per cent. glucose = a 24 hours' excretion of 50 grams sugar. Introduced with the diet are 80 grams, so that 30 grams remain assimilated—his "Tolerance." Now, the carbohydrates in the diet are gradually reduced, till a diet of albumin (meat, eggs, cheese, etc.), vegetables, fat is reached, which contains practically no carbohydrates. That diet has to be observed also 2 to 3 days, and more (under careful observation of the Fe_2Cl_6 reaction) and, on the last of those days, the urine has to be collected in the same way as described before. In most of the cases, we find it now free of sugar, and begin again to add a certain restricted quantity of bread to the diet. We should also, in our case, give the patient half a bread at lunch, and a quarter at breakfast and supper, after a few days collect the urine, and, if we find it free from sugar, continue a gradual increase of bread until we reach a diet so liberal that a further increase of the carbohydrates is superfluous for the comfort of the patient, for instance, 200 to 250 grams of carbohydrates, or their equivalents, per diem. Much more frequently we shall see, with a certain quantity of bread the reappearance of glycosuria, which means that the amount of carbohydrates given has exceeded the amount of which use can be made, the "tolerance" has been overstepped. In that case, we make the urine by 1 to 2 days' restriction of, or abstinence from, carbohydrates, free of sugar, and select as final diet a diet which contains less carbohydrates than the last, with which no sugar appeared in the urine, as we know by experience that it is much better not to make use of the full tolerance. As soon as the tolerance is fixed, to make the diet less monotonous, certain other articles of food containing carbohydrates are permitted, like milk, potatoes, fruit, etc., but with quantitative restriction, to replace partly, or entirely, the bread at the different meals.

In severe cases, in which, with a small amount of carbohydrates in the food, or even with purely albumin—fat—diet, sugar is excreted, it has to be tried, if by prolonged abstinence from carbohydrates, and even by, what von Noorden calls, vegetable days (days on which only green vegetables, with fat, coffee, soup, brandy, or whisky are given) the glycosuria could be diminished, or entirely suppressed.

In doing so, great care has to be taken, by a careful observation of the Legal's and Gerhardt's reaction, to keep the excretion of aceton, diacetic acid, oxybutyric acid under control, and also not to let the patient lose too much in weight. To go into further details would lead too far ; the general rules for the dietetic treatment of severe diabetes are the same also during a course of Carlsbad waters.

The diet is somewhat modified, in dealing with cases of fatty, or gouty glycosuria. In the former case, the quantity of the food, especially butter and other fat, is restricted, in the second, less meat is given, no strong soups, plenty of vegetables, and such albumin-containing articles of food, which, in the tissue-metabolism, give only a few purin bodies (eggs, cheese, etc.). A similar modification will take place in cases combined with chronic nephritis. The bread permitted is mostly in the form of Grahambread, which tastes very much like the English brown bread, and is made from Grahamflour (containing the whole grain). It weighs usually 100 grams a piece, and contains, if fresh, 50 per cent. amylum. That and nearly all bread-surrogates are to be had at Carlsbad, for instance all the Callard articles of food, which, in severe cases, are frequently made use of. In all the restaurants, there is a special list of dishes on the bill of fare, marked "for diabetics," and containing such dishes, which have only a negligible, or no, percentage of carbohydrates.

As to baths, Carlsbad, with its elaborate and luxurious bath-houses, offers to the prescribing physician a great variety from which to choose.

The common Sprudelbaths, fed by the Sprudel, have, according to modern views, most probably no specific therapeutical value apart from a possible suggestive effect, but they aid us, in the form of warm indifferent baths, in the proper care for the skin, a very important item in diabetes.

The mud-baths (peat-baths) are especially indicated, where we have to deal with chronic affections of muscles and joints in cases of gouty glycosuria, if neither the condition of the heart and vascular system, nor the general condition of the patient gives a contraindication. The artificial carbonic-acid baths (Nauheim baths) are very valuable, not only in case of slight weakness of the heart-muscle, but also as a good tonic in cases of debility, especial sexual debility, which we occasionally see in male diabetics, also in cases of partial paralysis of certain muscle-groups, the anæsthesia and paræsthesia by peripheral neuritis diabetica. The electric light bath is the most hygienic form of a sweating bath, and is used as such in cases of adiposity, chronic nephritis, and gout combined with glycosuria. The electric baths are applied as the two-cell baths system of Prof. Gaertner, in general nervous troubles, as insomnia, neurasthenia, etc.

The application of hydrotherapy in the form of Prof. Winternitz' cold-water cure is very beneficial. When applied in an appropriate way, it seems, in mild cases, to have a very favourable influence on the glycosuria, especially if it is of the nervous type, and acts very well on the general state of health and feelings, and, like the before-mentioned carbonic acid baths, stimulates debilitated sexual power. It is of undoubted use in neurasthenia, with which we so frequently meet in diabetics, if it is not applied by thoughtless routine, but according to the condition of the case, either in its stimulating or calming effects.

In accordance with the modern ideas, Carlsbad offers a rich opportunity for using all those methods which we comprehend under the name of physiologic therapy. Numerous (70 English miles) walks on comfortable, well-kept roads, and paths in the shady woods, full of the fragrant odour of pine-trees, partly in gentle ascents, partly on the level, give occasion for muscular exercise so important for the diabetic. (It is well known that under the influence of muscular exercise the glycosuria is often distinctly diminished). Golf-links, tennis-courts, a fencing-school in the open air provide opportunity for more active exercise, and there is also opportunity for engaging in shooting and trout-fishing. Patients, who are weak and easily tired, can, by the help of Swedish gymnastics, strengthen and invigorate their muscles by gentle and exactly measurable labour. For that purpose, the town council of Carlsbad has erected an institute for Swedish gymnastics, (Prof. Zander's system), with every comfort, and according to modern hygiene. This institute is furnished with the most complete set of machines, and is under the direct management of a physician, who has assistant physicians, whose duty it is to direct and superintend a correct carrying out of the procedures prescribed by him. In connection with those gymnastics, manual massage and electrotherapy are practised in the same institute by the superintending doctor and his assistants. But Swedish gymnastics are valuable not only for the training of weak muscles, but also for the treatment of adiposity and gout ; in the latter case, by using those apparatus which are to be moved by the patient, and those for passive movements, and the different machines for tapotement, vibration, and friction. And finally their therapeutical value in another frequent complication must not be forgotten—viz., chronic constipation. Manual Swedish exercises and massage are also, outside the town institute, practised by professional men, and well-trained lay masseurs and nurses. For electrotherapy in the form of a 4-cell bath, highly recommended by Prof. von Noorden for nervous complications with diabetes, as well as for the other branches of electrotherapy (Radiotherapy, Franklinisation, Arsonvalisation), proper institutes under professional direction exist.

Drugs are, as a rule, during the Carlsbad cure but rarely used. In pronounced acetonuria, either bicarbonate or citrate of soda, in large frequent doses, is given, and if, on account of diarrhœa, the last named cannot be given, chalk is used to combat the acidosis. Opiates are reserved for the most severe cases only.

If we take now into further consideration those factors, which are important in spa-treatment in general, the influence of changed surroundings, the freedom from all the excitement, sorrows, and troubles of business, social, and home life, a prolonged stay in open air, and especially the greater inclination of the patient, during his cure, which means for many of them a great sacrifice of time and money, to adhere much more strictly to the *régime* and other professional advice than when at home : in these particulars, at least, to some extent, does the good effect of Carlsbad treatment find its explanation, but in a still greater degree we must attribute it to drinking the waters at the place itself. And although I emphasise here that Carlsbad, in very advanced cases of diabetes with great loss of flesh, strong acetonuria, and highly increased excretion of diacetic, oxybutyric acid, and ammonia, not only proves, even with strictest diet, to be useless, but also frequently acts very injuriously by hastening the coma, through the fatigue of a long journey: yet it remains indisputable, that not only gouty or fatty glycosuria is beneficially influenced by Carlsbad treatment, but also those cases in which the distinction between glycosuria and diabetes would be very difficult, and, up to a certain degree also, cases of milder or not too severe forms of genuine diabetes.

The much-referred-to experiments of Kuelz gave no positive result, but they are not able to disprove an experience, gained empirically through many years in the spa itself. Kuelz made his hospital patients take Carlsbad waters, and could observe no benefit in his cases, so far as the glycosuria was concerned. He himself says that his experiments brought no final solution of that question, and Naunyn also does not consider them as decisive. Up to the present time we cannot say what changes, if any, the Carlsbad water undergoes in the time between its storage in bottles and its use. I only mention here the experiments of Bickel with Wiesbaden water, similar experiments with Carlsbad water not yet being in existence. Moreover, we miss a scientific experimental foundation for an explanation as to how and where in the system, the effect, proved by clinical empiry, is accomplished. One could imagine that the Carlsbad water, taken fresh from the spring, has a beneficial influence on the circulation and tissue-metabolism of the abdominal organs, but, as a not proved speculation, it finds no room in science. It may therefore be permitted to quote, as evidence, a case, which was under very careful observation before, during, and after his cure.

Mr. N., a lawyer from A., was sent to me, in the year 1898, by his brother-in-law, a well-known physician and prominent specialist for diseases of metabolism. The latter wrote to me: "Patient has a glycosuria of 1 per cent., with fairly strict diet, and the sugar will not disappear even with perfectly strict diet, there is a distinct Legal's reaction, and I am afraid that the case will change into the severer form of diabetes." Patient lost flesh and felt tired. No complication, no history of gout.

Patient underwent a regular four weeks' course of Carlsbad treatment, with the result that the glycosuria, and also Legal's reaction, disappeared, and he felt well and gained in flesh. His tolerance was increased to 100 gr. amylum per diem. During the following years, while under the strain of professional overwork and excitement, the glycosuria reappeared, but was promptly suppressed by Carlsbad. So far this would be no proof that the Carlsbad treatment, *sensu strictiori*, suppressed the glycosuria, it might have been the change of conditions, rest, and strict diet. But, and that is decisive, he tried the same treatment, with the exception of the Carlsbad waters, under the careful personal and skilful observation of his brother-in-law at F., also away from his house, and enjoying freedom from work and professional troubles, under perfectly changed conditions, strictly observing diet, etc., but with negative result, while Carlsbad promptly acted in his case.

This case teaches us, too, that it is better not to send the patient when "the case is bad enough for Carlsbad," but rather, in its earliest stage, before he is too advanced to derive any benefit, not only from Carlsbad treatment, but also from every other therapy known to modern medicine.

ON THE NERVOUS SYMPTOMS ASSOCIATED WITH GLYCOSURIA.

By JAMES TAYLOR, M.A., M.D., F.R.C.P.,
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WHATEVER view may be accepted as to the ætiology and pathology of diabetes and conditions generally in which sugar is present in the urine, it will not be denied that, in their origin and symptoms, these morbid conditions are closely related to the nervous system. The classical experiment of Claude Bernard, in which, by puncturing the floor of the fourth ventricle, he was able to produce glycosuria, needs only to be mentioned: and it may also be recalled that various injuries and diseases of the nervous system in different parts, for example, the medulla, cerebellum, spinal cord, sympathetic, and vagus, have been found associated with glycosuria. The same condition has been found present in cases of spinal cord disease, such as tabes and spinal cord tumour, and was also present in a case of tumour of the right vagus nerve. An appreciation of these facts is desirable before trying to set out the signs and symptoms of disturbance of the nervous system so often found in association with glycosuria.

Neuralgia is one of the common symptoms associated with glycosuria. The pain may be distributed in the region of any of the peripheral nerves, although it occurs most frequently in the lower limbs. It may be present, however, in the upper limbs, and in the fifth nerve area: the trunk also may suffer. When this is the case, the pain may closely resemble the girdle sensation of tabes and other spinal cord diseases, and, when this is associated with pains in the limbs, the resemblance to tabes may be intensified. It is said that paroxysmal sickness, almost like a gastric crisis, may also occur, and even the absence of the light reflex in the pupil has been described. The suspicion that the chief disease, in such a case, is tabes must necessarily be strong, yet the existence of ataxy with glycosuria has been proved: and this is not to be wondered at, considering the definite spinal cord lesions, closely resembling those of tabes, which Williamson has now conclusively shown to be not unusual in cases of diabetes.

Neuritis also occurs in cases of glycosuria. The so-called neuralgic pains are no doubt, in some instances, the result of sensory neuritis. In other cases they are probably central. Neuritis also probably accounts for the loss of the knee jerk in some cases, although in others the posterior sclerosis in the cord, already alluded to, is probably the cause of this loss. In some cases there is much muscular wasting, with changes in the electrical reactions, even the reaction of degeneration, pointing to the existence of definite inflammation, affecting the motor neurons. And, in many cases, there are the muscular wasting, the tender nerve trunks, the glossy skin, the loss of hair and nails, and the altered electrical reactions, pointing to a definite peripheral neuritis affecting mixed nerves. It is also possible that neuritis, affecting the vasomotor filaments, is the cause of the gangrene, which occasionally comes on in the course of glycosuria.

Symptoms of Spinal Cord Disease.—These have been already alluded to incidentally. Lightning pains, girdle sensation, gastric crises, ataxy, and even, it is said, the Argyll-Robertson pupil, may be present with glycosuria. In some cases of true tabes dorsalis, transient glycosuria has been noticed, but it is certainly the case that all the symptoms, enumerated above, may occur in cases which are not true tabes, but in which glycosuria is present. And, as already stated, it is not to be wondered at that such conditions are found, taking into account the recent observations of Williamson, who found in the cords of patients dying from diabetes, sclerotic changes in the posterior columns,—that is, changes in the region of the cord which is characteristically diseased in tabes dorsalis.

Special nerve symptoms may also be present. Deafness, with tinnitus, and even vertigo, has been found, the auditory nerve suffering alone, or sometimes in connection with otitis media. The symptoms of disturbance of the optic nerve are alluded to elsewhere.

Psychical symptoms are also common in glycosuria. Great depression, even actual melancholia, may be present. It is said that this depression occasionally alternates with the glycosuria—that when the former is present the latter is absent, or much diminished. But this is not invariably true, and occasionally profound melancholia may be present, just before the coma sets in. Diabetic coma, also, is of course a symptom of nervous affection, and is caused, no doubt, by the brain being flooded with poisoned blood, the nature of the poison or poisons being still a matter of discussion.

The treatment of these different conditions must, of course, be subordinated to the treatment of the chief disease, alluded to elsewhere, yet there are some details which should be mentioned. The neuralgic pains, etc., may be treated with phenazone, phenacetine, aspirine, or some such drug. Opium may also be used for this, as well as for the chief disease. The ataxy is best treated by rest, massage, and the use of exercises calculated to improve the co-ordination. If there is muscular wasting, the use of massage and the constant current, as in other forms of peripheral neuritis, is to be strongly recommended. The psychical symptoms are among the most difficult to influence favourably, and, for their relief, measures calculated to modify the general condition are mainly to be relied upon.

SKIN DISEASE ASSOCIATED WITH DIABETES.

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The subjects of diabetes are especially prone to certain forms of skin disease. These are either local affections, caused directly by the irritation of the sugar in the urine, or general dermatoses which are fomented, if not directly produced, by constitutional disease of which glycosuria is an expressed constitutional state. In both cases, the original lesions are aggravated, and greatly modified in character by scratching, and the consequent invasion of organisms of one kind or another. While having no special character that marks them as diabetic in origin, they have often a peculiar persistence and tendency to recurrence. There are, in fact, as Barthélemy puts it, no "diabetides" as there are "syphilides" and "tuberculides," but there are "para-diabetides." Whenever an affection of the integument is particularly refractory to treatment, the urine should be examined for sugar.

The local lesions in both sexes affect the orifices of the urinary passages, the external genitals, and the neighbouring parts of the skin. In men who suffer from diabetes, the meatus is often abnormally red. Erythema of a more or less acute character may occur, and is generally confined to the glans and the prepuce, but sometimes the inflammation attacks the penis, producing balano-posthitis which may be herpetiform in character. The process sometimes spreads over the scrotum to the perineum and inner parts of the thighs. The glans becomes dark red, and the epithelium covering it becomes roughened and thickened ; desquamation takes place ; abrasions may form and even deep cracks which bleed easily In severe cases there may occasionally be chancroid ulceration in the sulcus behind the glans. If left to itself, the prepuce becomes so much thickened that it loses its elasticity, and phimosis ensues, the end is wrinkled like a purse of the which the strings have been drawn tight.[1] It its swollen and marked by radiating fissures, from which oozes a sanious fluid, or blood. There is generally little or no pain, but the phimosis causes difficulty in passing urine, and this, in time, gives rise to local inflammatory troubles. If this state of things were allowed to continue, suppurative ulceration would follow, and this might easily take on a phagedænic character, and lead to sphacelus. I have known a case in which death resulted from this complication, the local necrosis giving rise to general sepsis.

The local lesions are, as a rule, more severe in the female on account of the larger surface affected, the erythematous process spreads from the urethral orifice to the whole of the vulva, into the vagina over the labia majora, the skin around the perinæum, and the contiguous aspects of the thighs. It may extend backwards to the coccyx and as far upwards as the umbilicus. In severe cases the borders of the vulva, and the vaginal orifice become swollen, and excoriations and cracks may form from which oozes a discharge. If not properly treated, a condition similar to that described in men may take place in women. The labia become swollen, sometimes greatly hypertrophied, and the parts are covered with vegetations and large papillæ. In other cases a condition of chronic lichenisation results, the parts becoming hard, thick, and slate coloured. The fæces in diabetes have often an irritable quality, due to the gastro-intestinal disturbance which is a common symptom of the disease. Hence itching of the anus is frequent, and may be accompanied by erosions, redness, and swelling of the orifice and parts around.

The first stage in the process, which gives rise to balano-posthitis in the male, and to vulvo-vaginitis in the female, is, in some cases at least, the deposit on the mucous membranes of a whitish layer of epithelial débris mixed with fatty matter, in which microscopic examination reveals spores and mycelial filaments (saccharomyces). The attention of the patient is called to the existence of this condition by the irritation which it causes. A like state of things occurs in the mouth, and on the inner surface of the cheeks.

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[1] Barthélemy in *La Pratique Dermatologique.* Traité de dermatologie appliqué par Ernest Resine, L. Brocq et L. Jacquet.

The chief symptom in both sexes is itching, which is usually severe, and may be of such intensity as to exclude the patient from society. The scratching, of course, makes breaches of surface, through which micro-organisms gain entrance, while the affected parts are in themselves favourable breeding grounds for parasites. The situation is complicated by the fact that the urine, which comes in contact with the parts, undergoes fermentation, which makes it more irritating. The operation of these various factors leads to the development of a number of lesions, vesicles, excoriations, pustules, scales, cracks, vegetations, etc., which make the genital manifestations of diabetes singularly polymorphous.

In its simplest expression the diabetic lesion is erythematous; on this basis an eczematoid eruption often develops. The hypertrophic lichenisation and gangrenous processes that have been described are fortunately rare.

The general skin diseases associated with diabetes, are of all kinds, the most common being boils and carbuncles. To these diabetics are particularly liable. They may be the subjects of erythema and eczema, herpes, of nearly every variety of lichen, psoriasis, urticaria, thrush, seborrhœa, acne, etc., but they are more susceptible to these diseases than other people, and when they do suffer from them the conditions present no characteristic features. There is, however, this peculiarity, that skin diseases, when associated with diabetes, have their ordinary features accentuated, while the duration is abnormally long. Thus eczema in a diabetic subject is apt to become severe, the ordinary colour of the lesions being exaggerated, the vesicles being extraordinarily numerous, pustules being abundant and profuse, the scales and crusts being unusually thick, and the borders of the lesions higher and thicker than is generally the case. The same statement holds good for boils, lichen planus, psoriasis, and other affections.

Thrush, too, is more intense and extensive and indefinite in duration. Other features of diabetic skin diseases are their multiformity, arising from the presence of mixed infections, and their tendency to relapse. These, while not of themselves warranting a diagnosis of diabetes, should excite suspicion.

A point of particular importance in the skin lesions of diabetes is the possibility of the supervention of gangrene, which may come on suddenly from a very trifling cause in persons to all appearance in robust health. It may occur in the form of islets of quite superficial necrosis, or may spread over a large surface causing serious destruction. Nevins Hyde (*Diseases of the Skin,* 1900, p. 331) has described what he calls a singularly well-defined eczema diabeticorum, which is to be recognised about the genital organs of both sexes, but more particularly in women, accompanied by the most severe pruritis, excoriations produced by scratching, an enormous tumefaction of the genito-canal and surrounding integument. The local symptoms are chiefly those of eczema erythematosus, the surface being, as a rule, destitute of either vesicles or pustules.

A variety of xanthoma, which occurs in association with diabetes, was described by me in 1883. Its special features are its rapid evolution, and its swift and complete involution. The lesions are distinguished from those of ordinary xanthoma by the presence of a raised red area around the yellow spots. They appear first in the extensor surfaces of the limbs, next on the lower part of the back and abdomen, on the buttocks, and on the penis. In some cases they have been seen on the palms, but only once on the eyelids. They generally disappear in a few weeks under anti-diabetic treatment. Xanthoma diabeticorum is commoner in younger adults, inclined to fatness. It is always associated with glycosuria, though sometimes no sugar may be found in the urine.

Of the pathological relations between diabetes and general skin diseases, there is nothing very definite to be said. Diabetes profoundly affects nutrition, and the skin naturally shares in the deterioration thus caused in other organs and tissues. The dryness of the skin, which is a frequent accompaniment of the condition, may make it more vulnerable to the attacks of microbes. The lessened alkalinity of the blood is said to diminish its bactericidal power. On the other hand, the perspiration, which occurs in diabetics of the plump and rosy type, is apt to give rise to sweat eruptions.

The diagnosis has to be made largely by exclusion. If the existence of diabetes is known, the practitioner will have no difficulty in assigning any erythematous or eczematoid eruptions, which may be on the genitals, to the right cause. But, as Fournier has pointed out, patients are apt to regard lesions in the genital region as the remains of syphilis, or old gonorrhœa. Indeed, ulcerations of the sulcus behind the glands sometimes resemble a syphilide so closely that the diagnosis may be almost impossible in a syphilitic who is also the subject of old-standing diabetes. In all cases of skin affections, which do not yield to treatment, it is a sound rule of practice to examine the urine.

Of course, it is essential to treat the underlying constitutional state. In the way of local treatment daily alkaline baths are particularly useful. They should be taken daily, and the patient should stay in the bath for a long time.

Weak solutions of permanganate of potash or sodium borate should also be applied several times a day, and the parts should be powdered with some soothing powder, such as bismuth or oxide of zinc, and contiguous surfaces should be kept apart with muslin bags. When the acute symptoms have subsided, weak resorcin ointment should be applied. Ulcerated surfaces should be treated with iodoform, aristol, or xeroform, and afterwards powdered with oxide of zinc or sodium bicarbonate. As a rule, moist applications are contra-indicated in the case of diabetic lesions. Gangrenous conditions, phimosis, etc., must be dealt with on ordinary surgical principles.

THE OCULAR COMPLICATIONS IN DIABETES MELLITUS.

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THERE are no marked pathognomonic ocular symptoms in diabetes mellitus, and nothing so characteristic as the retinitis of nephritis with its serious prognosis as to length of life.

Diabetes mellitus is essentially a condition of nutrition, and the ocular conditions, found in it, are due to faulty nutrition of the structures of the eye from toxæmia and impaired circulation.

Ocular manifestations are rarely met with in the early stages of the condition, but are not uncommon in the acute and also in the very chronic cases.

The ocular symptoms, usually associated with diabetes, are cataract and retinitis, and there are some more or less characteristic signs to perhaps warrant the terms "diabetic cataract" and "diabetic retinitis." Of these, cataract is the more commonly met with, and "diabetic" retinitis is a comparatively rare complication.

Most of the other symptoms and diseases occurring in diabetes are not in any way characteristic, and have their origin in the fact that the general condition is much enfeebled, probably from toxæmia.

It will be best here to first consider the two chief associated diseases, and then to briefly enumerate the other diseases and signs.

Cataract.—The prevalence of lenticular changes in diabetes mellitus has been known for many years, and it has been stated that, as many as one per cent. of patients with cataract, have sugar in the urine. It is difficult to formulate any diagnostic points of the so-called diabetic cataract. The patients are generally young adults, and, from this fact, in every case of bilateral cataract in a young person, the urine should be examined for sugar.

The cataract commences in the cortex, and is "soft" in consistency, even when the patient is over 40 years of age. As a rule, both eyes are affected, the cataract is rapid in progress, and soon tends to become "complete."

It should be borne in mind that there are several cases on record, in which marked cortical striæ have disappeared, in diabetics, under treatment for the glycosuria. It is interesting to note that these diabetic cases are the only ones known in which general treatment has effected a cure, or great improvement, in the condition of a cataractous lens.

Apparently, there is no relation between the cataractous condition and the stage of the diabetes, amount of urine passed, or the cachexia of the patient.

The question of operating in these cases must be carefully considered, as in some cases "coma" has supervened a few days after the operation of extraction. I have seen three such cases, but I think that, if the patient has been carefully treated, and the glycosuria reduced as much as possible, there is very little risk of "coma." Other troubles, which may supervene, as delay in closure of wound and tendency to plastic iritis, are again mostly due to the general health. Given the best possible conditions, I do not hesitate to operate in diabetic cataract, but, from the "soft" consistency of the cataract, should always advise the combined extraction operation (with iridectomy).

Retinitis.—This is a much rarer condition than cataract in diabetes, and is never found in its early stages. It affects both eyes, as a rule, and much resembles, in ophthalmoscopic appearance, albuminuric retinitis. There are, however, a few more or less distinctive signs, which enable the diagnosis, in some cases, to be made by the ophthalmoscope. It must, however, be always remembered that albuminuria is often present in diabetics, and that, therefore, the retinitis may be due to the kidney mischief, and not to the glycosuria.

The ophthalmoscopic signs are, as a rule, numerous retinal hæmorrhages of different sizes, which may be situated in the superficial, or deeper, parts of the retina; the retinal arteries show signs of degeneration and sclerosis.

There are many soft-looking, discrete, and confluent plaques and spots, which are white with a tinge of yellow ir colour. The edges of the plaques are rounded, and like soft cotton-wool. About the yellow spot region are often small white shining spots, but there is no tendency to the "stellate" or "crown" arrangement round the yellow spot, as in albuminuric retinitis.

As a rule, there are no signs of papillitis, and no black retinal pigment spots.

Œdema of the retina may be present in acute cases. Vitreous opacities are frequently met with. The vision varies greatly in different cases, and may be scarcely, if at all, affected; if much reduced in acuity, it is probably due to amblyopia from retro-bulbar neuritis, or from hæmorrhages.

The *prognosis,* so far as *vision* is concerned, depends, as a rule, on the amblyopia, and not on the severity of the retinitis.

As to *life,* the prognosis is not necessarily grave as in albuminuric retinitis; I have known patients alive for ten years and longer after the first signs were diagnosed; whereas, in albuminuric retinitis, the duration of life is generally under two years.

The differential diagnosis from albuminuric retinitis is made chiefly from the numerous retinal hæmorrhages, the more yellow appearance of the plaques, the absence of the star or ring around the yellow spot and black retinal pigment spots, the rarity of papillitis and œdema of the retina, the presence of vitreous opacities, and the prognosis as to life.

The treatment resolves itself chiefly into attention to the general health and condition. Locally, the main points are to rest the eyes, as much as possible, by avoiding reading, bright lights, etc., and by wearing coloured glasses. Of such glasses, the best are the spectrum blue, but lately I have been also ordering, with success, a yellowish shade called "focural."

Among the other ocular symptoms and signs in diabetes, the most common is a tendency to hæmorrhage, and the usual situations are the retina, subconjunctival tissue, and the vitreous. The retinal hæmorrhages may be solitary, or multiple, and, in the superficial, or deeper parts of the structure. Diabetes is one of the causes of hæmorrhagic retinitis—a condition quite distinct from "diabetic" retinitis.

The great lowering of the general system and the tendency to wasting is probably responsible for such conditions as insufficiency of convergence power, paresis of accommodation, early presbyopia, and increase in manifest hypermetropia. Toxæmia may, however, explain these last symptoms, and is also responsible for plastic iritis, iridocyclitis with hypopyon, relapsing scleritis, and uveitis.

To toxæmia must be attributed the amblyopia simulating uræmic poisoning, and diseases of the nervous system, as primary atrophy of the optic nerve, ophthalmoplegias, and retro-bulbar neuritis. Of these, retro-bulbar neuritis, with central scotoma, has been often found in diabetes, but almost always in patients who smoke tobacco, and the disease, therefore, is in most cases probably only the predisposing factor. Cases of retro-bulbar neuritis in women, and also in men who do not smoke, have been recorded, but are rarely met with in diabetes.

THE PULMONARY COMPLICATIONS OF DIABETES.

By J. J. PERKINS, M.A., M.B., F.R.C.P.,

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AMONG the complications, which may supervene in the course of diabetes, pulmonary diseases rank high both in frequency and importance, next, in fact, to the nervous affections, such as coma. The explanation is not far to seek. Not only are the possibilities of air-borne infection ever present, and the way open, but, in the individual, all the conditions necessary for the successful implantation of organisms are fulfilled; vitality is low, and resistance therefore impaired, while the richness of the tissues in sugar makes them neither more nor less than a culture medium ready prepared.

It is obvious that diseases so serious in themselves as pneumonia and phthisis must have a great effect on prognosis, when they are superadded to so serious a condition as diabetes: in fact they are a frequent and immediate cause of death. Their exact frequency, as we shall see, is a matter of much discussion and disagreement.

But besides the important bearing these complications have on the prospects of the patient, they present many points of interest in themselves. Under the influence of their special environment, peculiarities of type and unusual features are developed, such, for instance, as the tendency to necrosis and gangrene; while, on the other hand, they bring about changes in the symptoms of the original disease, such as the disappearance of the sugar from the urine.

The onset, again, of some of these complications is very insidious: masked by the weakness and emaciation, already present, they are apt to be overlooked, and may reach a serious degree before their presence is even suspected.

Seegen's table, from the post-mortem room of the Vienna General Hospital (given in Williamson's monograph on the disease) of the findings in 92 autopsies on diabetics, though, of course, not absolutely complete, sufficiently shows the conditions we have to discuss.

Tuberculosis	40
Croupous pneumonia	9
Lobular pneumonia	8
Œdema	13
Hyperæmia	4
Diffuse gangrene	2
Localised gangrene, from rupture of carcinoma of the œsophagus	1
Hæmorrhagic infarct	1
Total	78

That is to say, that, in no less than 78 cases out of the 92, lung complications of some degree of importance were present. Some of these, however (œdema and hyperæmia), may be dismissed at once as common post-mortem conditions, not special to diabetes, which might arise in any condition of debility and failing circulation; while gangrene of lung from rupture of carcinoma of the œsophagus is a well-known occurrence in the course of that disease.

Fat embolism of the pulmonary vessels, not mentioned in Seegen's list, a rare result of the lipæmia, may also be passed over, for, though scientifically interesting, it is of no great practical importance, though at one time credited with being a factor in the production of coma.

The pathology of the curious "breathlessness without dyspnœa"—Kussmaul's "air-hunger"—which is a main feature in one of the varieties of diabetic coma, belongs to the pathology of coma itself, and, not being essentially pulmonary, will not be included here.

After making these exceptions, there remain on our list three pulmonary lesions—*tuberculosis*, *pneumonia*, acute and chronic, *gangrene*—all complications of the first order.

TUBERCULOSIS.

The predominance of tuberculosis in Seegen's list (forty out of seventy-eight) well illustrates the commanding importance, which has always been recognised, of phthisis among the complications of diabetes. The word phthisis is used advisedly, for among the points, which have been most debated, is the question whether the diabetic phthisis of the older observers is always tuberculous.

Incidence.—Before considering this point, it will be well to consider first the question, also hotly debated, whether such figures can be accepted as generally true of the prevalence of phthisis among diabetics, or whether, as many hold, they give an unduly gloomy picture. The writer leans to the latter view, a considerable experience in various chest hospitals having shown him that diabetes is much more of a rarity among the phthisical than one would expect if phthisis were such a common complication of diabetes. Lists like Seegen's are drawn from hospital work, and, while true of the poor in the advanced stages of the disease, are not to be taken as true of private practice, or of the disease in general. In favour of this is the experience of spa physicians, who find phthisis to be a rare complication among their patients. Von Noorden's figures give us the amplest data at our command for settling the question. In 252 cases, mixed hospital and private, of diabetes, he found phthisis in 33.

Williamson, on the other hand, in 100 consecutive cases, mostly hospital, found signs of advanced lung disease in 14, slight apical signs in 14 more, to which had to be added another case, latent during life, or 29 in all.

The *social condition*, then, is one great factor in determining the incidence of phthisis in diabetes, and figures will vary, according as they are drawn from hospital or private work.

Further important factors are the *age* of the patient and the *severity* of the *diabetes*. Rare in the old and gouty and in slighter cases, phthisis is a frequent complication in the young, and in severe cases; von Noorden makes 5 per cent. of sugar the dividing line, although that amount may be only temporarily reached.

Tuberculous Nature of Diabetic Phthisis.—Both in its symptoms and in the morbid anatomy of the lung, diabetic phthisis presents some differences from the ordinary run of tuberculous cases. As might be expected, when the powers of the patient are undermined, and his resistance diminished, extensive caseation is common, and evidences of the cicatrisation, or effort at repair, which are so prominent in most cases of chronic tuberculosis, are wanting. Relying on points like these, and on others, such as the reputed rarity of miliary tubercles, the older physicians argued that the phthisis of diabetes was frequently non-tuberculous. A similar opinion, it will be remembered, was held with regard to the destructive diseases of the lung caused by the inhalation of irritating dust, until Koch's discovery of the bacillus showed that most of these cases were tuberculous, the irritant merely paving the way for the tubercle bacillus, and only modifying the picture of the disease. In the phthisis of diabetes, history has repeated itself, and modern methods show tuberculosis, though occasional exceptions must be admitted, to be the rule.

The site occupied by the lesions in the lung is usually that typical of tuberculosis. Of Williamson's 28 cases, all but two were apical: many of these could be proved to be tubercular, and, in his opinion, probably all were. Of the two basal, one was doubtful, the other certainly non-tubercular, bacilli being absent from the sputa, and from sections of the lung, while inoculation into a guinea-pig was negative. Dreschfeld reports another, and the writer, in his own experience, met with a case of extensive grey consolidation of the lung, in which all efforts to discover the tubercle bacillus failed.

The existence then, in diabetes, of a chronic pneumonia, apart from tuberculosis, must be admitted, but is evidently exceedingly rare.

Symptoms.—The phthisis of diabetes, though tuberculous, is described as following, in some points, a peculiar course. All writers insist on its latency, which may reach such a pitch that it may pass entirely unnoticed, and be first discovered post-mortem, or when some accident, such as a pneumothorax, compels attention. Cough is not a marked symptom, expectoration is scanty, fever slight, and hæmoptysis rare. There has perhaps been too great a tendency to emphasise these points, and, out of them, to construct a special type. In those cases of tuberculosis with marked caseation, *i.e.*, with a rapid course, expectoration is often scanty, and hæmoptysis uncommon, while the emaciation and prostration of the original disease will seem a sufficient explanation of the patient's condition, and tend to divert attention from the presence of complications. Even those who insist on these peculiarities have to allow exceptions. Not all the cases run a rapid course, some are chronic : hæmoptysis may occur ; in fact, in one case in the writer's practice, recurrent hæmoptysis was one of the chief features. Indeed, all the ordinary symptoms of phthisis may be present.

Prognosis.—The prognosis, though dependent on the age and the severity of the diabetes, must on the whole be unfavourable. A case of von Noorden's, which he quotes for that purpose, warns us, however, not to be too pessimistic. The patient was a man of fifty-three, with signs of bronchial catarrh, but with tubercle bacilli in the sputa, and ulceration of the larynx. Sugar was present to the extent of 4 per cent. Under strict treatment, the sugar sank to half per cent., the larynx healed, and the expectoration ceased, the patient remaining in good health nine years later.

The more chronic cases, if not curable, are capable of considerable improvement, which von Noorden says he has often seen last for a year or longer.

Treatment.—Bearing in mind the tendency of the diabetic to tuberculosis, it follows that he should, with especial care, be shielded from the dangers of infection. After the disease has declared itself, the ordinary treatment for diabetes will still be followed, but the nutrition should be watched with more than usual care, and the diet relaxed or varied, in order to secure the optimum.

Such patients are unfitted to cope with the full rigours ot sanatorium treatment, at any rate, in bleak or cold situations or weather, and, while they should be given the benefits of open air methods, a fairly warm and sheltered situation must be chosen.

GANGRENE.

Von Noorden gives a larger place than most other writers —some of whom, indeed, describe it as rare—to the occurrence of gangrene of the lung in diabetes. According to him, it is not uncommon, and not an uncommon cause of death. In his article in Nothnagel's *Encyclopædia,* he quotes details of thirteen cases from his own practice, all, except one, ending fatally.

He recognises two types, an *acute*, with high fever, and running a short course, seen only in severe cases of diabetes with more than 5 per cent. of sugar; and a *subacute*, or *chronic*, in older people.

In both forms, the diabetes may be latent and unrecognised, until the onset of the gangrene.

In the *acute* group, the physical signs are those of pneumonia; the sputa soon become bloody (even hæmoptysis may occur), but never, or hardly ever, fœtid. This extraordinary absence, both in life and post-mortem, of the usual characteristic factor of gangrene has been noticed by all writers, almost without exception.

Post-mortem, necrotic and purulent areas are found, with the surrounding tissue in a state of pneumonic infiltration, the whole looking like the necrosis of a pneumonia. Whether there is a special infective agent is unknown; in one case Kitasato found the staphylococcus albus only.

In the *chronic* group, affecting older, well-nourished diabetics, fœtor of the sputa apparently may be present. In this class, a curious cycle of diminution, or even disappearance, of symptoms, followed after some days or weeks by their return, is described.

The physical signs are those of catarrh, and, as elastic tissue is not to be found in the sputa, von Noorden looks upon these cases as due, not to the necrosis of an extensive area of infiltration in the lung, but to multiple small peribronchial necroses.

Fever is slight, hæmoptysis may occur, and in one case ended life.

PNEUMONIA.

The same tendency to necrosis is seen in pneumonia arising in the course of diabetes, and even occasionally in tuberculosis. Apart from this tendency to gangrene, the prognosis of pneumonia in the diabetic is bad, death often occurring within 24 hours (Bouchardat). Occasionally, a case may recover. Dreschfeld describes the disease as resembling the pneumonia of the alcoholic, the onset being insidious, and lacking the customary rigor, while the pyrexia throughout is not high.

GLYCOSURIA.

With the onset of the pneumonia, the sugar in the urine diminishes, to rise again after the crisis, though Bouchard quotes one case, in which pneumonia was followed by a lasting diminution in the amount of sugar. This diminution in the sugar is not confined to pneumonia, but occurs with the tubercular complications, and indeed is the rule in them. Rarely the sugar may completely disappear, as in three cases of diabetes quoted by Williamson, all of the severest type, in which the thirst and polyuria passed off, and the whole aspect of the case was changed. More commonly there is marked diminution, but not total disappearance. Occasionally, but exceptionally, the sugar remains unaffected.

DIABETES AND INSANITY.

By THEO. B. HYSLOP, M.D.,
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THE relationship of diabetes to insanity is manifold, and there are various questions of extreme interest which occur to the medico-psychologist. Savage, in a paper read before the Medical Society of London in 1890, stated that diabetes and insanity alternate in families (one generation being diabetic, and the next insane, or *vice versâ*) ; and also in individuals, acute diabetes being replaced by acute melancholia, this latter giving place again to diabetes, which was again replaced by temporary mental depression. In two cases, elderly men suffering from diabetes, melancholia appeared shortly before the fatal termination, and the sugar disappeared. Besides patients with diabetic relatives, Savage had ten patients in Bethlem, who were both insane and diabetic. He found nearly all the cases of insanity with diabetes were melancholiacs. My experience coincides with that of Savage, but, of late years, I have seen several cases in which the symptoms were those of actual cerebral degeneration and dementia.

Sugar in the urine[1] has been found in several cerebral diseases and cerebral lesions, in which there were no evident pathological changes in other organs. Recklinghausen[2] found melituria in the case of a tumour of the fourth ventricle. Dompeling[3] in a tumour of the medulla. Giovanni in sclerosis of the right cerebellum, Zenker in disease of the fourth ventricle; Mosler in a case of softening of the nucleus dentatus in the cerebellum. Diabetes coincided with a case described by Mosler, in which there was a new formation in the fourth ventricle, with a case of tubercle in both hemispheres described by Roberts, with chronic inflammatory changes in the calamus scriptorius (Lancereaux), with crysticercus in the brain (Frerichs), with encephalitis of the fourth ventricle and its surroundings (Pribram), and with carcinoma of the glandula pituitaria (Massot). Gooden found sugar in the urine of many cases of epilepsy, paralysis, and chorea, but that this disappeared as symptoms were relieved by treatment. Ordinarily there was no diuresis; urine often turbid and ammoniacal.

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[1] *Dictionary of Psychological Medicine*, by Dr. Hack Tuke.

[2] *Virchow's Archiv.*, Bd. XXX., S. 360, 1864.

[3] *Ref. Centralblat. für die Med. Wissenschaft*, 1869, S. 144.

In my experience, diabetic insanity is more common in males than in females, and the age is usually between 50 and 60 years. In addition to external injuries where the head has been the seat of injury, there appears sufficient evidence to believe that mental anxiety, emotional strain, shocks, and even violent passions may be followed by diabetes. Careful examination of the nerve tissues is not, as a rule, attended by positive results. In two cases of dementia with diabetes, I found marked arterial degeneration with sclerosis of the cerebral cortex, and a general condition of cytoclasis. The condition of the peripheral nerves is sometimes indicative of neuritis, and pathologically their appearance is apparently the same as in ordinary alcoholic neuritis.

From the clinical standpoint there would appear to be several relationships of diabetes to insanity. These are :—

(1) Alternating states of diabetes and insanity. Sometimes the periodicity of the disordered metabolic processes gives rise to a coincidental periodicity in mental phases, and I have seen several cases, in which there was a tendency to psychorhythm, or so-called circular insanity. In these instances, the insanity was undoubtedly due to faulty metabolism, and they might with justification be classified under the toxæmiæ.

(2) Conditions of melancholia, not necessarily chronic and incurable, in which the melancholia may be an incident in the course of the diabetes, or the diabetes may be incidental to the melancholia. The association may be accidental, and without obvious dependence the one upon the other. In such cases, recovery from the melancholia is not uncommon.

(3) Dementia, when it does occur in relation to diabetes, is usually a sequel to repeated and long-continued psychical shocks, albuminuria, vascular degeneration, and renal disease. This sequence renders its occurrence of grave import, and

I have not seen any recover from dementia with progressive loss of memory and general failure of the mental faculties.

(4) Dementia paralytica, or general paralysis of the insane, in association with, or due to, diabetes, is extremely rare. When the association does occur, the mental and physical nervous symptoms may simulate those of general paralysis in some respects, but the clinical picture is usually incomplete, and the subsequent history and pathological findings demonstrate the dissimilarity. I have seen one case of a man, aged 52, who, without a history of syphilis or alcoholism, gradually became confused, exalted, amnesic, and unable to control his excitement, whilst physically there was some degree of paresis of accommodation, and retinitis, absence of wrist jerks and knee jerks, but the plantar, abdominal, and epigastric reflexes were readily obtained. The presence of sugar in the urine proved the case to be one of the pseudo general paralytic type. Subsequently, symptoms of diabetic coma supervened, with dyspnœa, cyanosis of the hands and extremities, and death. Slight degeneration of the fibres of the posterior columns was found.

Albuminuria with glycosuria are not infrequent in general paralysis, but, in my experience, the glycosuria is an incidental factor, or complication, rather than a cause of the general paralysis.

(5) Delusional states, without obvious melancholy or exaltation, sometimes occur. The metabolic defects may be attended by confusion of the mental faculties, with inability to interpret correctly the impressions derived through the special senses. The delusions, therefore, have a sensory origin, and when they do occur, they usually have reference to some bodily state. In one case, there was mild optimism, confusion of ideas, and subsequent delusions that the ground was soft and therefore dangerous to walk upon. There was no polyuria or great thirst, but the knee jerks were absent, and there was anæsthesia and analgesia of the distal extremities of the arms and legs, this probably (as in tabes) giving rise to defect of static and pressure sense, whereby the feet seemed to be coming into contact with soft material.

6. In some cases of acute mania, there may be considerable glycosuria, which may improve, or entirely disappear.

Traumatic mania of an impulsive and violent kind may exhibit glycosuria, but I have never seen the condition followed by actual diabetes mellitus.

7. The psychopathic temperament with defective inhibition, convulsive tendencies, paroxysmal attacks, and mental infirmity, may be the expression of a psychosis in the offspring of a diabetic parent without any evidence of actual diabetes in the offspring.

8. Various forms of paralysis, with or without aphasia, sometimes of a transient nature, may form a prelude to uræmic or diabetic coma. It is important to note that the auto-intoxication sometimes occurs suddenly, and the danger is subsequently enhanced by too rapid changes of food, stoppage of opium or codeia, any moral or physical shock, over-fatigue, alcoholic indulgence, etc. When coma and dyspnœa occur in an insane patient, together with true diabetes, the prognosis is extremely grave, although I have seen some amelioration of the symptoms, and in one case there was sufficient improvement in the mental state to permit the completion of a will which was held to be valid.

M. Chauppe[1] reports a case in which aphasia was a passing symptom in the course of diabetes insipidus; he was fatigued by walking, became comatose, and when found was aphasic, but produced a hospital ticket, on which were the words "polyurie simple." About ten minutes after having drunk nearly two litres of water, he recovered his speech, and M. Chauppe attributed his aphasia to simple dehydration of the blood, and this possibility must be held in view in ordinary diabetic cases, in which the blood is sometimes remarkably sticky and dehydrated, even without the presence of acetone.

The occurrence of aphasia with hemiplegia was, in one of my patients, attended by an uncontrollable tendency to weep whenever spoken to or approached in any way, but there was no sensory defect, perception was normal, and, for a period of nearly ten years, the symptoms remained stationary. There was perfectly sound disposing capacity, and, in spite of the physical and emotional instability, this patient was, in my opinion, quite competent to make a will.

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[1] *Cerebral and Mental Symptoms*, J. C. Simpson, p. 92.

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DIABETIC GANGRENE.

By CUTHBERT WALLACE, M.B., B.S. (Lond.), F.R.C.S. (Eng.),
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This disease is usually found in patients about the age of 60 years, and occurs more frequently in males than in females. It generally attacks the extremities, and the lower extremities very much more often than the upper. Sometimes the first sign of disease is the appearance of the gangrene itself. At other times, there are premonitory symptoms. The patients suffer from tingling or burning sensations. Sometimes the pain is very slight, amounting to not much more than an aching sensation. At other times it is paroxysmal, and very often so intense as to be hardly endurable. It not infrequently happens that patients about this age find that they are unable to do the same amount of walking as formerly, and are very subject to fatigue after an amount of exercise, which, a few years before, would have produced no effect upon them. At other times, the patients will volunteer the statement that they are more subject to cold, and that their circulation has become less brisk.

The ways, in which the gangrene first makes itself manifest, are numerous. Sometimes it occurs spontaneously. At other times, it is the result of a trivial injury, or thirdly, the gangrenous process spreads from a pre-existing ulcer. When it occurs spontaneously, it may result from exposure to cold, but may appear when no such cause can be assigned. The digits become cold, blue, and discoloured, the discolouration being usually found in the neighbourhood of the nail. This discolouration, instead of subsiding, persists, and, becoming darker, at last takes on an inky hue. In a certain number of cases, the process stops here, and nothing more results than a superficial exfoliation of the skin, and possibly of the nail, healing very often taking place underneath, before the separation of the skin or nail. At other times, the black area will extend, the toes shrivel, become dry, and mummified. At this stage, the disease may be arrested, the dead parts thrown off, and healing result. It is not unusual to obtain a history of several similar attacks. Those cases, in which the gangrene is confined to the toes, and in which nature effects a cure, although it may be only temporary, are the most favourable that are met with.

In other cases, the gangrene extends on to the dorsum of the foot, and produces there a similar condition of mummification to what it has done in the toes. This mummification may, though rarely, affect the whole foot. More commonly the gangrene, when it has reached the foot, takes on the appearance of an unhealthy, non-healing ulcer, and, when this is the case, the condition is the same as that generally met with when the gangrene starts in the foot itself, as the result of an injury, or as a gangrenous process engrafted on a pre-existing ulcer.

The most usual place in which the gangrene starts, under the latter conditions, is in the ball of the big toe, where it may commence as the result of a rub of the boot, or a prick of a nail, or very commonly round a suppurating corn, or what is sometimes called a perforating ulcer. It is well known that such suppurating corns very often open up the joint between the phalanges and metatarsus. The edges of such an ulcer are generally precipitous and white, on account of the sodden condition of the thick epithelial of the sole of the foot. One day it will be noticed that the edge is discoloured. The patient, at first, may think little or nothing of this appearance, and dismiss it from his mind. If it persists, he will most probably seek the advice of his medical attendant. The latter will recognise what this blackening means, but since it is very hard to convey the seriousness of this condition to the patient, it is unlikely that very active measures will be taken; the progress of disease can, therefore, be watched. The discolouration spreads away from the ulcer, the skin becomes dusky, and dark, and soon enters into a condition which is unmistakably that of gangrene. The dead skin itself may become dry and parchment-like, or remain sodden. A line of demarcation will form around this gangrenous patch of skin, but, having formed, shows but little inclination to throw off the dead tissue. It develops, in other words, into an unhealthy ulcer with a dirty base, and a precipitous, or rolled edge, one side of the ulcer formed by the dead, the other by the normal skin, the latter showing signs of a low inflammatory condition. This ulcerative process, if it has started on the sole, extends round to the dorsum, and involves the toes, which become black and then mummified. The process having got thus far is nearly always progressive. The ulcer will perhaps deepen and expose the tendons or bones. When a definite limit has apparently been placed to the disease, the healthy tissues, beyond the line of demarcation, will break down, and another zone of the limb become involved. By such successive steps, the ankle is reached and then the calf, provided that the patient has not succumbed to septic infection before this time. While the gangrene is confined to the foot, where the structures contain comparatively little moisture, consisting as they do of muscle and bone, the gangrene always has a tendency to pass into a state of mummification, but when the more succulent tissues of the leg are reached, such a happy state of affairs rarely occurs, and the gangrene remains moist.

This condition, just described, occurs independently of any septic infection of the part. Such infection, however, may take place when the gangrene is still limited to a small portion of the limb, and is very prone to take place by the time the gangrene has reached the ankle or lower part of the leg. The supervention of a septic condition is one of extreme gravity, and its onset must be carefully watched for. It declares itself in various ways, but the most trustworthy are, acceleration of the pulse, muttering delirium, first noticed about night-time, and a brown and dry condition of the tongue. Fever is not a sign to be depended upon. It may be high, but is often absent from first to last. When a fatal termination is approaching, the patient becomes restless, picks at the bedclothes, and passes into a condition of coma. The description has so far been confined to the lower extremity, but the disease is also seen in the upper extremity, and, not infrequently, one limb after another is affected. Sometimes a distal segment of a limb becomes suddenly gangrenous from the lodgment of an embolus. Such is the clinical picture of the disease.

It will be interesting to enquire what is the essential cause of the gangrene. It has been considered, by some, to be due to an unhealthy condition of the tissues brought about by the excess of sugar in the blood, or anyhow by the process which produces the excess. If the diabetic state by itself were responsible for this disease, it would be expected that the gangrene would be found at the time at which diabetes is most rampant, that is, in the young. As a matter of fact, it is very rarely seen under such conditions. In eleven years, 26 cases were admitted into St. Thomas's Hospital. The average age of these patients was just under 60.

Again, neuritis, which undoubtedly accompanies diabetes, has also been assigned as a cause. It is true that there is not infrequently a loss of proper sensation in the feet, but this loss is also to be noted in simple senile gangrene. The death of the parts in this disease is not the same as is met with in cases of death, or loss of parts caused by trophic influence, such as is seen in painless whitlow and similar diseases.

Inflammatory conditions have also been advanced as a cause, and there is no doubt that inflammation is the cause of the spread of the gangrene, the parts being unable to resist the inflammation, which is necessary for the throwing off of the dead tissue and the subsequent repair. It remains, however, to ascertain why the parts are unable to withstand the reparative process. In 24 of the 26 cases mentioned above, an opportunity occurred of examining the arteries, and in every case there was well-marked atheroma. During the last five of the eleven years mentioned above, a careful microscopic examination was made of the arteries, and, in every case, such gross arterial tissue was found, as would perfectly account for the occurrence of the gangrene without other factors.

The vessels in these cases are in a state of advanced atheroma. In the large vessels, such as the femoral, the atheroma takes the form of localised patches of thickened intimacalcareous plates and atheromatous ulcers. The arteries are hard and incompressible. The lumen is irregularly reduced, but still of fair size. In the small or more distal arteries, the process is somewhat different, the thickening of the endothelium being a marked feature, so that the lumen of the artery is greatly reduced, or altogether obliterated. Such a condition of things must naturally produce starvation of the parts. In addition to the narrowing of the lumen, the blood supply may be further reduced by thrombosis. This starvation is itself sufficient to produce death of the parts, or, if some slight trauma is received, to prevent the tissues standing the necessary strain put upon them by the inflammation of repair. It would therefore appear that the essential cause of the gangrene is gross arterial disease. It may be that the glycosuria is a contributing factor to the degeneration of the vascular system, but it is only by its effect on the arterial system that diabetes produces gangrene. The proportion of males and females, affected in this disease, seems to bear out this contention, as in 26 cases, 22 were male and 4 were female, while diabetes is said to occur twice as often in the male as in the female. These cases of so-called diabetic gangrene are nearly always admitted to the wards of a hospital as senile gangrene, and it is only when the urine is tested, and sugar found in it, that they are labelled as diabetic gangrene. Very frequently, the only symptom of diabetes is the presence of the sugar ; the other symptoms, such as thirst and wasting, are in a good proportion of cases entirely wanting. The amount of sugar varies very much ; there may be thousands of grains passed in the 24 hours, or only a few. The behaviour of the sugar, after amputation, also varies. It may be but little affected by the ablation of the diseased limb, or it may fall in amount or even disappear, at any rate, for a time.

TREATMENT.

These cases should be treated on exactly the same lines as are now adopted in the cases of senile gangrene. There are two possible courses to be adopted. (1) Palliative treatment. This consists of rest in bed, keeping the parts as dry and sweet as possible, limiting the quantity of starchy foods, and the possible administration of codeia and opium, with a view to reducing the amount of sugar, and checking the pain. The parts must be allowed to separate by nature, the sloughs being perhaps detached artificially as they loosen. No local amputation is of any avail. (2) Radical treatment. If the gangrene has reached the foot, it is not worth while waiting on the chance of the disease spontaneously healing.

The only method of treatment is that recommended by Jonathan Hutchinson in senile gangrene, namely, amputation in the upper part of the limb. In the case of the leg, this would be either below the knee, or in the lower third of the thigh. The latter is by far the better, for here a circular amputation can be performed, which leaves the skin well supported by its subcutaneous tissue and underlying muscles, while an amputation below the knee necessitates the use of long skin flaps, which are very prone to slough. Under certain conditions, ablation of the limb becomes imperative, if the patient's life is to be saved. The condition referred to is the occurrence of septic absorption. When the symptoms of an accelerated pulse, nocturnal delirium, and a dry tongue are present, it must be explained to the patient, or to his friends, that the only chance of life is the loss of the limb. Even then prognosis is not nearly so favourable, as if the amputation had been carried out before these symptoms had declared themselves.

The diminution or disappearance of the sugar, after the removal of the limb, and the septic absorption produced by it, is a remarkable feature in a certain number of these cases, and it suggests that the glycosuria may itself depend upon, or be aggravated by, the septic lesion. It is well known that cellulitis, cellulo-cutaneous erysipelas, erysipelas, carbuncles, and other sloughing processes produce glycosuria. As an instance of this, the following cases may be quoted :—A woman, aged 65, was admitted with a carbuncle of the back of seven weeks' duration. The urine contained 300 grains of sugar in the 24 hours. The slough of the carbuncle was excised, and the sugar disappeared from the urine in nine days, and was still absent six weeks later. Case 2 : A man, aged 72, was admitted for the operation of excision for carcinoma of rectum. After a few days the wound became very foul, and the urine, which before operation was normal, was found to contain sugar which amounted to 2,300 grains in the 24 hours. After the wound became clean, the sugar fell, and at the end of a month was only present as a trace.

In neither of these two preceding cases was there any sign of diabetes with the exception of the glycosuria, and the diet in each case was unrestricted. If the assumption, that the septic processes lead to glycosuria, is correct, we should expect to find that individuals suffering from septic diseases are nearer glycosuria than those in a normal state.[1]

It has been shown that a healthy man can dispose of 300 grams of glucose at a meal, while the patient who is suffering from septic absorption cannot dispose of as much as 50 grams. An example of this is the following :—A man, aged 31, was admitted with lymphangitis of the arm. His temperature was 104. 50 grams of glucose, given with porridge in the morning, produced a well-marked glycosuria. When the patient was convalescent, and the inflammation had ceased, this same patient took 300 grams at a meal, none of which reappeared in the urine. Similarly, another patient, aged 72, who was admitted with senile gangrene, exhibited glycosuria after taking 300 grams. After the leg had been removed and the wound healed, the same patient showed no signs of sugar in the urine, until 500 grams of glucose were taken at a meal. It would therefore appear that the presence of sugar in the urine may, in certain cases, be an indication for operation instead of the opposite. By ablation of a limb, we may not only rid the patient of a painful and distressing local condition, but may actually produce an improvement in nutrition, as shown by the diminution, or disappearance, of the sugar from his urine.

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ON DIABETES IN CHILDREN.

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THE object of this paper is to give a short account of the clinical features of diabetes mellitus occurring in childhood. Compared with the adult form, the condition, as seen in children, presents certain distinctive features, which collectively indicate a greater severity of type ; the onset is more sudden, the course more rapid, and the termination is almost invariably fatal. Further, there appears to be a greater freedom from associated diseases, especially pulmonary complications.

All writers on the subject agree that diabetes is rare in children, though wide variations are found in the figures given by them to show its relative frequency in children and adults. I have recently investigated the records at St. Bartholomew's Hospital, and have found that during the 22 years, 1885 to 1906 inclusive, 506 patients of all ages were admitted suffering from diabetes. Of these 27, or 5·4 per cent., were of 16 years of age or under. I shall give later the ages of these 27 cases. During the last 20 years, so far as I can ascertain, only two cases of diabetes have been admitted to the East London Hospital for Children, Shadwell—a remarkable contrast to the figures obtained from the St. Bartholomew's records. It might have been expected that many more cases would have been found at the Children's Hospital, situated as it is amongst a large Jewish population, and where children are taken in up to 14 years of age.

We may conclude that diabetes in children is certainly uncommon, but that probably it is not so rare as is generally supposed. I am inclined to think there is a considerable risk of cases being overlooked, especially those occurring in infants and quite young children, owing to the frequent absence of a routine examination of the urine such as is made with older patients. There are obvious difficulties in obtaining specimens, but it is highly important that the urine of every child admitted to a hospital should be collected and examined, at least once, for the presence of sugar or other reducing bodies. Much valuable information as to the occurrence of these substances would be gained by that procedure. Copper-reducing substances are often to be found in the urine of infants and young children, and not uncommonly may be due to an "alimentary" glycosuria: lactose, in the case of breast-fed babies, is said to be frequently present. Further investigation as to the frequency of occurrence, and the nature of these bodies is greatly needed.

Age.—Diabetes may occur during the first year of life. Stern collected six cases, in one of which sugar was found to be present at birth, and others have been recorded since the publication of his paper, but such cases are extremely rare. In the 29 cases, of which I have notes, the ages were as follow:—

3 years, one case.
6 years, two cases.
7 years, one case.
8 years, two cases.
9 years, one case.
10 years, two cases.
11 years, three cases.
12 years, one case.
13 years, two cases.
14 years, four cases.
15 years, seven cases.
16 years, three cases.

Sex.—Among adults, the male sex is more liable than the female, and the same holds good in the 29 cases quoted above. Of these 17 were males and 12 females. This does not agree with the figures given by Stern and others, who find that diabetes in childhood affects the female more than the male sex in the proportion of 5 to 3.

Heredity.—There is strong evidence that heredity must be regarded as an ætiological factor in diabetes of children of as great importance as it is in adult cases. I might quote many recorded instances showing a strong family history of the condition, in either one or other of the parents, or in one or more of the brothers and sisters. As to my own series, the evidence is interesting though inconclusive; in one case, a sister, aged 8 years, died of diabetic coma; in two cases, the grandmothers had diabetes; in one, the grandfather; and in one, the great-grandmother. As regards *race*, there does not seem to be the same liability in Hebrew children that we find among adults of that race.

Exciting and Predisposing Factors. — Injuries, especially falls and blows on the head, have been considered by some writers as responsible for the onset of certain cases of diabetes in children, but the evidence is as inconclusive here as it is in other ailments of children. On the other hand, acute illnesses may be followed by the development of diabetes. In one of my series, it directly followed typhoid fever, in another a severe cold and sore throat. Other factors, such as over-exertion and shock, may be present: one of my cases followed severe over-fatigue; and in another, a fatal case, of between two and four months' duration in a boy of 14, there was clear evidence that it dated from the operation of circumcision. Over indulgence in sugar and starchy food has been ascribed by several writers as an element in its causation. In the great majority of cases of diabetes in children, however, no definite exciting or predisposing cause can be found.

Clinical Course of the Disease.—I have selected the following fairly typical case to illustrate the course taken by the disease in a child.

The patient was a girl, aged 9½ years, who had been in apparently quite good health till five weeks previous to coming under my observation. Polyuria and excessive thirst were then noticed, and she began to lose weight, having previously been an unusually plump child. She had had no past illness, and the family history was good. She had a healthy, well-nourished appearance when seen by me. The skin was somewhat dry and harsh, and there was slight pruritus vulvæ. The heart and lungs were natural. The specific gravity of the urine varied from 1030–1040, the amount passed per diem was between 3 and 4 pints and contained from 4·5 to 7 per cent. of sugar. There was a very definite aceto-acetic acid reaction with ferric perchloride. Under treatment, she improved to a slight degree as shown by a gain in weight, and a diminution of the amount of sugar passed, but the iron reaction persisted. Eight months after the onset of the disease, she caught cold, began to pass more water and to lose her appetite; five weeks later she had an attack of toothache with swelling of the face and two days after this, the breathing was noticed to become noisy. She became gradually weaker, and died 60 hours after the onset of the dyspnœa, consciousness having been retained until one hour before death. No post-mortem examination was made. After the initial slight loss of weight, very little further wasting took place. The total duration of the disease in this case was little more than nine months. No examination of the urine was made during the last eight weeks, the iron reaction was constantly present up to that time.

The case illustrates several points which are conspicuous in diabetes as seen in children. In the first place, the onset is often remarkably sudden, polyuria, thirst, increased appetite, and wasting being the symptoms that first attract the parents' attention that something is amiss with the child. Occasionally, though rarely, the polyuria may be so slight that its escapes notice. It is not uncommon to find little or no obvious wasting, so that the patient may present a healthy well-nourished appearance which sometimes is retained to the last.

In two cases, of which I have notes, one a boy, aged 12, the other a girl, aged 3, nocturnal incontinence of urine was the first symptom to draw attention to the polyuria, and I would emphasise the importance of a careful examination of the urine in children affected in this way.

The amount of urine passed varies very greatly in different cases: in one fatal case, a girl aged 6, duration about 9 months, about 3 pints was the average daily amount; whilst in another very acute case, in a boy aged 14, ending fatally in 6 weeks from the onset, as much as 20 pints were passed. Langstein records a case of an infant, 1¼ years old, who passed 5½ litres, more than 9 pints per diem.

The amount of sugar passed also varies widely in different cases; 1,000 to 3,000 grains per diem may be given as the usual limits, though this amount is often largely exceeded. One feature of diabetes, as it occurs in children, is that the amount of sugar excreted does not generally diminish under treatment to the same degree as it so often does in adults. In many of the series of cases which I have investigated, little or no reduction was brought about by strict diet and drug treatment. Any sudden fall in the amount of sugar, passed without an adequate cause, should be viewed with apprehension, and it generally signifies the onset of coma. The coincidence of an acute illness may also cause a remarkable reduction in the quantity of the sugar or even its complete absence. One of my series, while in the hospital, contracted scarlet fever, and this was accompanied by a considerable fall in the sugar excreted. Baginsky records a similar instance in a child who acquired typhoid fever whilst under his observation, when the percentage of sugar fell from 2·7 per cent. to 0·11 per cent.

The presence of aceto-acetic acid in the urine, shown by the so-called iron reaction, is a point of very great importance. It appears to be present in most cases of diabetes in children. In only one of my series is it recorded as absent, and that was a mild case in a girl of 16, who greatly improved under treatment. Unfortunately, the presence or absence of the reaction is not stated in some of the cases. The significance of the reaction will be referred to later in its bearing on prognosis, but it may be stated at once that the presence of aceto-acetic acid in the urine is of very grave import in a diabetic child. Acetone and diacetic acid may occur in the urine of non-diabetic children in febrile states, starvation, gastro-enteritis, etc., and their significance is not fully understood. Their occurrence with sugar in the urine should arouse anxiety, which should not be allayed if the ferric perchloride reaction still persists, even if the sugar considerably diminishes in quantity, or disappears. Dr. Hale White has recently reported to me an interesting case of a diabetic child whose urine gave this reaction. Under treatment, the sugar became greatly reduced in amount, and finally disappeared for a period of between six weeks and two months, though the iron reaction persisted strongly throughout. At the end of this period the child died with typical diabetic coma, without reappearance of the sugar. I would take this opportunity of thanking Dr. Hale White for permitting me to quote this case.

Skin affections are not very common in diabetic children. The skin is often dry and harsh; pruritus, boils and carbuncles, etc. occasionally occur.

Gastro-intestinal symptoms are more frequent in children than adults, and I do not think sufficient attention has been directed to at least one of them namely, vomiting. Attacks of vomiting may come on suddenly and without apparent cause, and may usher in the final stage of coma. I have noted its occurrence in seven of my series, and, in some of these, it recurred several times, the attacks being generally attended by drowsiness. Constipation is common, and when severe may be associated, in children, with an aggravation of the symptoms and drowsiness. Diarrhœa is much rarer, when it occurs it may immediately precede coma.

Temperature.—This is frequently subnormal during the course of the disease, especially in the severe cases with attacks or drowsiness. It generally falls during coma.

Eye affections are much more uncommon than in adults: cataract especially so: it occurred in one of my cases in one eye. Diabetic retinitis is exceedingly rare. The shortness of duration of the disease in children may explain the infrequency of eye complications as compared with adults.

Duration of the Disease.—This is very variable though conspicuously shorter than in the adult type. The majority die within one year from the onset of symptoms. The shortest duration in my series was 16 days, and the next 6 weeks: both of these cases were boys 14 years old. The most acute cases are generally described as occurring in very young children, and this is probably correct. It is worth noting that the youngest case in my series, a child of 3 years, terminated with coma 2 years and 9 months after the onset, but this is undoubtedly exceptional.

Mode of Termination.—In many cases, the final symptoms make their appearance without warning, apparently without cause. The child may have been progressing favourably, when drowsiness and dyspnœa ("air-hunger") suddenly come on, and are followed in a few hours by coma and death. There is often some apparently slight cause which appears to precipitate the termination, such as constipation or diarrhœa, toothache (in 2 of my cases), a boil, or abscesses (2 cases). Convulsions are rarely present: they occurred in one case only, and investigations of recorded cases show that they are most unusual.

Prognosis.—Diabetes mellitus occurring in children must be regarded with the greatest apprehension, and I should agree with Senator that the outlook is hopeless. Cases of recovery are recorded, but they are few in number, and later details as to their further course are wanting. The presence of aceto-acetic acid in the urine of diabetic children renders the prognosis even graver than it is in the case of adults under similar conditions.

The more favourable cases are those in which acetone and diacetic acid are absent, and in which improvement under dietetic treatment occurs; but even in these the chances of recovery are remote though the fatal termination may be delayed.

Age may also influence the prognosis, as the disease appears to take on a comparatively milder type after the 13th or 14th year.

The occurrence of attacks of vomiting, or of occasional drowsiness, should be regarded as most grave indications.

Morbid Anatomy.—I have records of the post-mortem examination in 8 cases of fatal diabetes in children, and in 3 only were found any signs of associated disease. In one, calcareous mesenteric glands, and calcareous nodules in the liver, were present, with slight recent endocarditis and old pericardial adhesions. Microscopic examination of the pancreas showed slight fibrosis around the ducts. In another case, a calcifying gland was found in the mesentery. In the third, there was caseation of the apex of one lung, with pneumonic consolidation below and slight caseation of the mesenteric glands.

Treatment.—This can be expressed briefly, as it differs in no essential details from that to be followed in the case of adults. Warm clothing, avoidance of over-exertion, and careful regulation of the bowels are most important. Constipation should be strenuously guarded against, as diabetic children are especially liable to this, and the presence of scybalous masses may lead to attacks of drowsiness and dyspnœa. Diarrhœa, if it occurs, should be checked at once. As to diet; if the urine does not give the iron reaction, the carbohydrates may be gradually reduced as in the case of adults, but, if the reaction is present, the greatest care should be exercised in their reduction. The onset of the reaction, or of drowsiness, should be met with an addition of carbohydrates to the diet.

As to drugs, it is generally accepted that the free administration of alkalies in the form of sodium carbonate is advisable, and large doses, ʒss.–ʒj., every two hours should be given if coma threatens. In conjunction with careful regulation of the diet and alkalies, sodium salicylate and aspirin, opium or codeine appear to be of most advantage. The chief distinction between the treatment of a diabetic child and of a diabetic adult, on which special emphasis should be laid is that, in the case of the child, a strictly carbohydrate-free diet can rarely, if ever, be adopted without bringing about an increase in the acetone and aceto-acetic acid reaction, and a greater liability to coma.

THE URINE IN DIABETES.

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THE abnormal composition of the urine in diabetes is an expression of the altered composition of the blood, brought about by the various errors in metabolism, which we group together under the clinical term diabetes. These changes in metabolism are diagnosed and studied clinically by examination of the urine; and by the same means, to a large extent, we gauge the effect of treatment, and estimate the prognosis. In this article, we have to consider neither the nature of the metabolic errors nor their cause, but only their effect on the composition of the urine. But, even for this purpose, it is necessary to insist that diabetes is not a single condition, but a collection of pathological conditions, which have only one symptom in common, namely, an excess of dextrose in the blood, and therefore in the urine. For this reason, there is nothing to be gained by trying to draw any fundamental distinction between diabetes and glycosuria, and we shall not do so. There is no reason, at present, for believing that there occurs in man a renal form of glycosuria, comparable with experimental phloridzin diabetes, that is, a glycosuria, due to change in the kidney, and independent of an alteration in the composition of the blood.

We have to consider, in the first place, the one symptom, which is common to all forms of diabetes, namely, glycosuria, and, in the second place, the changes in the urine characteristic of the different clinical varieties of diabetes.

A.—GLYCOSURIA.

Normal urine contains dextrose, but in quantities insufficient, as a rule, to give the ordinary clinical test for its presence, namely, the reduction of Fehling's solution. In any case, suspected of diabetes, it is necessary to determine the presence or absence of a copper-reducing substance in the urine, and then, having found one to be present, to prove that it is dextrose. When using the reduction of Fehling's solution for the diagnosis of glycosuria, fallacies of two kinds have to be considered.

(*a*) The reduction may be due to other causes than the presence of carbohydrate material. The Fehling's solution itself may be bad, and have undergone decomposition. This fallacy is avoided by using a freshly prepared solution, and by boiling it before the urine is added. A second and more serious source of trouble and doubt is the fact that healthy urine contains traces of dextrose, and, in addition, urates and kreatinin, both of which are copper-reducing substances. When normal urine is boiled with Fehling's solution, the dextrose and urates almost immediately exert their reducing power, but no change in the fluid is visible, because the reduced suboxide is held in solution by the kreatinin present. If the boiling is continued for two or more minutes, the solution may begin to become opalescent, and to change in colour to green, and, on cooling, an indistinct greenish-yellow precipitate may be visible. This delayed precipitation of the reduced suboxide is due to the kreatinin becoming partially destroyed, and therefore unable to keep the suboxide in solution. When the quantity of urates, relative to the kreatinin, is great, as in a concentrated urine, the precipitation will take place earlier. It follows, from these facts, that the smaller the abnormal quantity of dextrose present in a glycosuria, the more will the kreatinin interfere with the precipitation of the reduced suboxide, and the longer will the fluid have to be boiled before the reduction is obvious. These difficulties, however, in a majority of cases, are more apparent than real. When Fehling's solution is being boiled with a urine containing as little as ·4 per cent. dextrose, a yellow precipitate is obvious after 10 seconds, and when the dextrose present is only ·1 per cent., the precipitate is seen after 30 seconds. One may therefore say that, if a suspected urine, after being boiled with Fehling's solution, shows no yellow precipitate after 10 or, at most, 30 seconds, the quantity of copper-reducing substances present is not abnormal. Another but rare fallacy of this kind is the presence of homogentisic acid in the condition known as alkaptonuria. This urine reduces Fehling's solution readily, but it neither ferments, nor gives the phenyl-hydrazine test; it turns dark slowly when exposed to the air, and at once on the addition of an alkali.

(*b*) The reduction may be due to the presence of a carbohydrate material other than dextrose. Of the conditions in which this may occur some are relatively common, others are extremely rare; but all, when they do occur, are equally important in diagnosis. (1) *Lactose* may occur in the urine of women who are pregnant or suckling. The sugar is absorbed from the mammary glands and excreted in the urine. Lactose reduces Fehling's solution readily, it gives characteristic crystals with the phenyl-hydrazine test, and does not ferment with pure yeast. (2) *Glycuronic acid* and its compounds are constituents of normal urine, which reduce Fehling's solution, but are present usually in quantities too small to produce an abnormal reduction. Some drugs, such as morphia, chloral, camphor, menthol, naphthol, turpentine, antipyrine, etc., may lead to such an increased excretion of glycuronic acid as to cause a reduction of Fehling's solution. These compounds do not ferment, and, although they form osazones with phenyl-hydrazine, the crystals are not sufficiently characteristic to be recognised. (3) *Pentose.*—The excretion of a 5 carbon sugar in the urine is a rare condition, but it is of importance because it is due to a peculiarity of metabolism, which has no pathological significance, and is therefore comparable with alkaptonuria or cystinuria. A pentose reduces Fehling's solution slowly, and does not ferment. It might be confused with a glycuronic acid compound. From this it can be distinguished, because it gives a positive reaction with the orcein test; further, the pentose which is found in urine gives an osazone with a characteristic melting point. (4) *Lævulose.*—This sugar is occasionally passed out by diabetic patients together with dextrose, and is then of little practical importance. But, in very rare cases, the urine may contain lævulose alone, a condition which might easily be mistaken for diabetes. Lævulose gives many reactions similarly to dextrose; it reduces Fehling's solution, ferments, and gives an identical osazone with phenyl-hydrazine. Unlike dextrose, it gives Seliwanoff's reaction. This reaction, however, is not characteristic of lævulose, and, in order to prove its presence for certain, it would be necessary to obtain the characteristic osazone, which it gives with methyl-phenyl-hydrazine. (5) *Cane-sugar* is sometimes added to urine with the idea that its presence will simulate glycosuria. The detection is quite easy, for cane-sugar ferments, but does not reduce Fehling's solution until it has been inverted by boiling with an acid.

From what has been said, it will be clear that it may be necessary to use three tests in order to prove that glycosuria is present: Fehling's test, fermentation, and the phenyl-hydrazine reaction. They may be applied for clinical purposes in the following way:—

(1) Use Fehling's solution. If the result is negative, glycosuria is absent.

(2) When Fehling's solution is reduced, but the clinical symptoms of diabetes are not present, try the fermentation test. If the result is negative, glycosuria is not present; and if it is positive, the only practical fallacy is the possible presence of lævulose.

(3) When Fehling's solution is reduced to only a slight extent, or a rapid diagnosis is necessary, then the more delicate and rapid phenyl-hydrazine test should be used. If no deposit is obtained, glycosuria is absent. If, however, an amorphous deposit, or crystals, some of which are not characteristic in shape, are obtained, it is necessary to recrystallise from hot alcohol, before it can be said for certain that they are not due to the presence of dextrose or lævulose.

In regard to the methods of estimating dextrose in urine, the most suitable for clinical work is either Pavy's or Gerrard's modification of Fehling's original method. Both are quick and sufficiently accurate. Pavy's method is slightly the more accurate, because the reaction has a better end point, and his solution keeps much better than Gerrard's. On the other hand, Pavy's method requires much more practice and attention to detail; it is quite possible for the inexperienced to obtain concordant results, which are 50 per cent. too low. Gerrard's method does not admit of such large errors being made, and for this reason is preferable for most clinical workers.

B.—OTHER URINARY CHANGES.

The condition of the urine is by no means the same in all cases of diabetes. It is therefore necessary to classify the cases. And, for this purpose, it is more convenient to adopt a purely clinical classification than to attempt one based on pathology. The cases will be divided into three classes, according to the effect of diet upon the excretion of sugar. Class I. includes all cases whose urine rapidly becomes free from sugar. In Class II., we place the cases whose urine never becomes free from sugar even when placed upon a rigid diet. Class III. contains certain cases which are intermediate between the other two.

Class I.—Of 692 cases of diabetes observed by Külz, 384 belonged to this class. Since the urine soon becomes free from sugar, when a rigid diet is given, it follows that the dextrose in the urine is derived only from carbohydrate, and not from proteid or fat.

(1) *The Urine passed on an Ordinary Diet.*—The quantity of dextrose excreted in 24 hours by different patients varies from a few grams up to several hundred. This dextrose represents the difference between the total quantity of carbohydrate in the food, and that which is assimilated by the tissues. Not only do patients eat very different quantities of carbohydrate, but the power of assimilation varies widely in different cases; consequently the quantity of dextrose in the urine of one case, as compared with another, is no criterion of their relative severity, unless the diet and assimilating power are taken into account.

The total quantity and specific gravity of the urine varies enormously. In a majority of cases, the quantity is moderately increased, because the excess of dextrose in the blood acts as a diuretic. But it is not unusual to find patients, who pass considerable quantities of sugar, without showing any diuresis. Further, in one case as compared with another, there is no necessary parallelism between the total quantities of urine and of dextrose secreted by them. One patient, passing one litre of urine a day, may excrete just as much dextrose as a patient secreting three litres; in other words, the percentage of dextrose in the urine of the two cases is very different. In any given case under constant conditions of diet, etc., the percentage of sugar in the urine is fairly uniform, and the total quantities of urine and dextrose do run more or less parallel.

The specific gravity of urine is determined by the total quantity of solids excreted, and the amount of water in which they are dissolved. Both of these factors vary much in different cases. It is not true that the urine of all cases of diabetes has a high specific gravity. When the kidney is excreting a large percentage of dextrose, the specific gravity of the urine is necessarily above the normal; but when the urine contains only a small percentage of sugar, and there is a large diuresis, the specific gravity may be no higher, and may even be well below that usual in health. In other words, the specific gravity of the urine is of no diagnostic importance unless the total quantity of urine is also taken into account. Many cases of diabetes, who pass urine of abnormal specific gravity, whether it is high or low, have kidney disease as well as diabetes. Of the 384 cases in this class, which were observed by Külz, 160 had general arterio-sclerosis and granular kidneys, or some form of nephritis. The presence of renal disease may be inferred from an examination of the urine in two ways—(*a*) The specific gravity of a 1 per cent. solution of dextrose in water is approximately 1·004. If the percentage of dextrose in a urine is known, it is easy to calculate the specific gravity of the urine apart from the dextrose in it. Knowing this, and taking the total quantity of urine into account, it is often possible to infer that the kidney would still secrete a urine of abnormal specific gravity if the glycosuria were absent. (*b*) The vast majority of cases of diabetes pass traces of albumen, either occasionally or regularly, and quite apart from any demonstrable lesion in the kidney; and the same is true of granular and hyaline casts. When, however, the quantity of albumen and casts is larger and constant, it is likely that some form of renal disease exists. It is most important to distinguish this constant presence of albumen and casts from the sudden appearance or increase in albumen and casts, which is an early and sure sign of the onset of diabetic coma.

In all other respects, the urine of the cases in this class is normal so far as concerns the diabetes. It does not give the nitro-prusside test for acetone, nor the ferric chloride test for diacetic acid; the excretion of ammonia and the percentage of the total nitrogen excreted as ammonia are within the normal, in other words, there is no acid intoxication.

(2) *The Urine passed on a rigid Diabetic Diet.*—When such a patient is given a diet, as free from carbohydrate as possible, the sugar in the urine begins to fall at once. In a large majority of cases, the urine becomes free from sugar in two or three days, and certainly within a week, if the patient belongs to this class at all. At the same time the quantity and specific gravity of the urine cease to be abnormal, if they have been so, provided, of course, that the kidneys are healthy.

The change in the diet produces other alterations of the urine. The total nitrogen and the acidity are greatly increased, the percentage of the total nitrogen, excreted as ammonia, may be slightly raised, and the urine may give faint reactions with the clinical tests for acetone and diacetic acid. But it is important to remember that these changes are shown also by a healthy man placed upon the same diet, and, in the case of these diabetics, are not to be taken as an indication that the diet might cause such an acid intoxication as to produce diabetic coma.

Two other facts about the urine, which are connected with the treatment of these cases, may be referred to. Since the objects of treatment are to make the urine sugar-free, and then to give nearly the largest quantity of carbohydrate that the patient can assimilate, as shown by his urine remaining free from sugar, it is necessary to mention the glycosuria, which follows, when the patient is given carbohydrate in excess of his assimilating power. It is found that this excess of carbohydrate in any given meal is all passed out as dextrose in the urine within the next six hours, the maximal excretion taking place in the second and third hours. In other words there is alimentary glycosuria. This phenomenon is found in all diabetics of every class; there is therefore no justification for looking upon alimentary glycosuria as a special form of diabetes. The second point is the connection between exercise and the quantity of sugar excreted. In most cases of this class, it is found that bodily exercise has a marked effect in aiding the diet to render the urine free from sugar, and to raise the power of the tissues to assimilate carbohydrate.

We see, therefore, that, in the cases included in this class, the determination of the presence or absence of sugar in the urine, and the estimation of it, when present, afford a satisfactory guide in both diagnosis and treatment.

Class II.—The cases included in this class are those whose urine is not rendered free from sugar, even when they are given the most rigid diabetic diet; in other words, they excrete dextrose derived not only from the carbohydrates of the food, but also from proteid, or fat, or both. They are, therefore, the severe or "composite" cases of diabetes. Of the 692 cases, investigated by Külz, 189 belonged to this class.

(1) *The Urine passed on an Ordinary Diet.*—The total quantity of urine and dextrose passed in 24 hours, and its specific gravity, call for no special comment; they are all very variable, as in Class I. Whilst it is true that many of these patients secrete very large quantities of urine and dextrose, it by no means follows, when the quantity of both is small, that the case is not one of the severe type.

The errors in metabolism, which characterise these cases, produce corresponding changes in the urine. Acetone and diacetic acid are present in abnormal quantities, and the urine gives the clinical tests for these substances. When the quantity of urine is not very great, there is no difficulty in recognising their presence; but when the urine is abundant and very dilute, it is possible, unless care is exercised, to overlook them. The urine contains β-oxybutyric acid also; there is, however, no simple test for this substance, consequently it can be recognised, with certainty, only by somewhat elaborate methods. Although the urine contains abnormal quantities of these and other organic acids, it does not show, as a rule, that the body is actually suffering from an acid intoxication; in other words, the total quantity of ammonia in the urine, and the percentage of the total nitrogen, excreted as ammonia, are little, if at all, above the normal. The urine of other cases, in a more advanced stage of the disease, shows that acidosis is present; a patient may, of course, develop diabetic coma when taking an ordinary diet. But even when actual poisoning by these acids is absent, the analysis of the urine shows that anything, which exaggerated the error of metabolism in certain directions, might easily convert a potential into an actual acid intoxication.

(2) *The Urine passed on a rigid Diabetic Diet.*—Diabetes of this severe type is a condition which, on the whole, changes for the worse, it may be rapidly or slowly. Cases necessarily come under observation at very different stages ; in fact, no two cases are exactly the same. In describing the changes in the urine produced by a rigid diet, we will assume that the case has reached an advanced stage of the disease. Similar but milder changes are observed in less advanced cases.

The immediate effect of cutting off carbohydrate food is to reduce greatly the dextrose in the urine, and, at the same time, the quantity of urine secreted. In a very few days' time other and important changes become extremely obvious. The diacetic acid reaction is much deeper in colour, the quantity of ammonia, and the percentage of the total nitrogen excreted as ammonia, are rising rapidly day by day ; in other words, the urine shows that the body is being exposed to an acute intoxication by acids. At the same time the patient's appetite is poor, he loses weight, and, in spite of the nitrogenous diet, the total nitrogen in the urine is often much less than on an ordinary diet, and the excretion of dextrose reaches its lowest level. At the end of a week or fortnight of the diet, some patients develop diabetic coma, which is ushered in by nausea, vomiting, albuminuria, and the passage of numerous casts. Other patients pass through this stage without developing coma ; they become accustomed to the diet, and the clinical symptoms of acute acid intoxication diminish. Correspondingly the diacetic acid reaction becomes less marked, and the quantity of ammonia in the urine decreases absolutely, and relatively to the total nitrogen, but both remain very definitely increased as compared with the same patient on an ordinary diet.[1]

If the rigid diet is still continued, two further phenomena are of frequent occurrence. The first is occasional attacks of loss of appetite and nausea lasting a few days, and accompanied by a temporary increase in the depth of the diacetic acid reaction. The other is a very slow but steady rise in the quantity of sugar excreted, showing that a gradual deterioration in the power of the tissues to assimilate carbohydrate is taking place; this is generally accompanied by a corresponding loss of weight.

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[1] Some of the observations recorded in this paper are taken from unpublished work done in conjunction with Drs. Pembrey and Spriggs.

From what has already been said, it will be seen that the estimation of the dextrose in the urine by itself affords no guide to the treatment of those cases. On the one hand, when the glycosuria is being reduced by a rigid diet to its lowest level, the treatment may be driving the patient into diabetic coma by converting a potential into an actual acid intoxication. And, on the other hand, when the patient is being given known quantities of carbohydrate food, it does not follow, because a larger quantity produces a greater glycosuria, that the patient is not assimilating a greater proportion of this carbohydrate, and is not all the better for the larger amount. This is a point of very great importance in treatment. The usual method of estimating the assimilating power is to get the excretion of sugar fairly constant, say, 100 grams a day, then to add to the food a single known dose of starch, say, 30 grams, and to estimate the dextrose in the urine of the next 24 hours. Supposing that 115 grams are found, then the patient's assimilating power appears to be limited to 15 grams of added carbohydrate. But if the same patient is given 100 instead of 30 grams of starch, it may be found that the next day's urine contains only 130 grams of dextrose; in this case, although the glycosuria is greater, the patient has assimilated 70 instead of 15 grams of added carbohydrate.

It is necessary to mention the effects on the urine of certain forms of treatment other than by diet. Exercise does not produce the beneficial results observed in the cases of Class I. Opium, codein, secretin, and extracts of pancreas do not produce, as a rule, marked or constant changes in the composition of the urine. Alkalies, such as bicarbonate of soda, which are given to counteract the acid intoxication, produce very definite effects. Besides often causing some diarrhœa, a rapid increase of weight, due to the retention of water in the tissues, and an œdema like that of nephritis, alkalies alter the composition of the urine materially. The acidity and the quantity of ammonia are diminished, but the total quantity of urine is increased. The diuresis leads to a washing-out of nitrogen and dextrose from the tissues. In spite, however, of this increased glycosuria, alkalies actually improve the power of the body to assimilate carbohydrates. One other change is of great clinical importance, namely, the fact that alkalies enormously increase the diacetic reaction in the urine. This increase can hardly indicate a greater acid intoxication, and must be due to better elimination.

Since acidosis is one of the greatest dangers in severe diabetes, and, since its presence is shown in the urine long before it gives rise to marked symptoms, it is necessary to have a clinical guide to the degree of the acid intoxication. Estimations of the ammonia, total organic acids, etc., are often impossible. The best rough guide is the depth in colour of the diacetic acid reaction. Unfortunately, the colour gradually fades, and it is therefore not possible to keep standard solutions for comparison ; but a very little practice enables one to judge by eye the depth of colour. The reaction is increased by cutting off carbohydrates from the food, by intercurrent attacks of nausea, by general anæsthetics, and, enormously, by alkalies ; it is diminished by the assimilation of carbohydrates, and after spontaneous recovery from an attack of nausea.

Class III.—This class contains those cases which are intermediate in character between the other two. Diabetes is, in many cases, a progressive condition, which continually tends to change from the mild to the severe form, as differentiated by the arbitrary criterion, by which we have distinguished them. It follows naturally that a certain number of cases must come under observation in an intermediate stage. Of the 692 cases, investigated by Külz, 119 were in this condition ; that is to say, they did not become sugar-free within a week of strict dieting, but, on the other hand, they did not respond to the diet like the cases in Class II. We have seen that the cases in Class I., when placed upon a rigid diet, become sugar-free within a week, and without showing any signs of acid intoxication ; and that the cases in Class II., on the same diet, never become sugar-free and develop an increased excretion of organic acids which is permanent, and most marked at first. Both lots of cases show equally the phenomenon of alimentary glycosuria. It is convenient and useful to divide the cases in Class III. into two groups, according to whether, under treatment, they progress or retrogress in the severity of their symptoms.

Of these 119 cases, 78 became sugar-free within a week of dieting. But their urine, instead of remaining free from dextrose so long as the diet continued, began, after an interval of a few days and upwards, to contain sugar, at first intermittently, and then constantly. Consequently, the cases were progressing from a mild towards the severe type of the disease. This change may be brought about acutely and permanently by a carbohydrate debauch, anæsthetics, intercurrent disease, or mental strain.

The converse change is less common; 41 cases came under observation, suffering from a mild type of the severe form of the disease, and, as a result of treatment, ultimately became sugar-free, 26 permanently, and 15 only temporarily. Cases of this variety do not lose their glycosuria within a week of receiving a strict diet. At first, under treatment, their urine may show a very definite diacetic acid reaction; but this disappears completely, the sugar in the urine slowly falls, and, at the end of a month, or a great deal longer, disappears altogether. But, as has been stated already, such a good result is by no means necessarily permanent, and a marked change for the worse may rapidly follow a return to ordinary diet.

ACETONURIA:

ITS CLINICAL SIGNIFICANCE AND TREATMENT.[1]

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Many pitfalls beset attempts to apply theoretical conclusions, ormed in the laboratory, to clinical work, but such attempts are necessary to progress. The subject of acetonuria is worth consideration from this point of view, because the conclusions can be readily tested in the light of everyday experience.

It has long been known that acetone appears in the urine, and in the breath of a diabetic patient, who is progressing unfavourably. In fact its presence is a better gauge of the patient's condition than the amount of sugar in the urine. But more recently, chiefly owing to von Jaksch, it has been recognised that this symptom appears in a great many other conditions, such as the recurrent vomiting of children, the pernicious vomiting of pregnancy, delayed chloroform poisoning, broncho-pneumonia, fevers, prolonged rectal feeding, carcinoma of the digestive organs, and various other diseases. It is also stated to occur in uræmia, but I have never found it, though I have examined carefully for it in several cases.

What general significance is to be attached to a symptom appearing under conditions apparently so diverse?

I.—THE SIGNIFICANCE OF ACETONURIA.

Acetone comes from the unstable diacetic acid. If this abnormal acid is being excreted slowly, it will all break down into acetone. But, if more than half a gramme of acetone is being excreted in a day, diacetic acid is certain to be found also. In a fatal case of diabetic coma, quite recently, I found abundance of diacetic acid but no acetone; I presume because it was being excreted too rapidly to have time to decompose.

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[1] The substance of this paper was given as an address before the Hunterian Society.

The odour, variously compared with that of hay or of apples, which is noted in these cases, is due to diacetic acid rather than to the acetone which has a more penetrating odour.

It follows that the recognition of the diacetic acid in the urine is of greater importance than the detection of acetone, its decomposition product, and this is convenient, for diacetic acid is very easily tested for. On the addition of ferric chloride, a claret colour results, which (unlike the somewhat similar colour seen on addition of this reagent to the urine of patients taking salicylates or carbolic acid), does not appear, if the urine has been previously boiled.

Acetone is best detected by the addition of a few drops of a freshly prepared solution of sodium nitro-prusside, and then excess of caustic soda, when a ruby red colour is developed, which is intensified and turned purple on addition of acetic acid. Creatinin, a normal constituent of urine, gives a transient colour with nitro-prusside and caustic soda, which is destroyed at once by acetic acid instead of being intensified.* Acetone is a very volatile substance, and the reaction can be prevented by previous boiling, herein again differing from creatinin. Diacetic acid in its turn is usually derived from β-oxybutyric acid. There is no convenient clinical test for this body,† but it is probably present when the diacetic reaction is well marked. This is, however, not necessarily the case. It sometimes cannot be found in diabetic coma, and it may be absent in the acetonuria of broncho-pneumonia. (Garrod.) The chemical changes involved are simple. β-oxybutyric acid yields diacetic acid by oxidation, while diacetic acid is converted into acetone by the loss of CO_2; thus

$$\begin{aligned} &CH_3\ CHOH\ CH_2\ COOH &&= \beta\text{-oxybutyric acid.}\\ &CH_3\ CO\ CH_2\ COOH &&= \text{Diacetic acid.}\\ &CH_3\ CO\ CH_3 &&= \text{Acetone.}\end{aligned}$$

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* It has been recently pointed out that if a strong solution of ammonia be floated on to the top of the urine after addition of the nitro-prusside, a magenta-coloured ring appears at the line of contact and diffuses upwards. Acetic acid is not needed and the possibility of confusion with creatinin is avoided. (Jacksontaylor, *Lancet*, 1907, I., p. 805. Lange, quoted by Cammidge, *ibid.*, p. 911.)

† After fermentation to remove the sugar, the concentrated urine is distilled with strong sulphuric acid, and the distillate examined for crystals of α-crotonic acid. β-oxybutyric acid is also lævorotatory.

The first of these changes is peculiar to the body, while the second can hardly be prevented.

So far as we know, *the immediate precursor of acetone is a fatty acid.* What then is the source of the fatty acid ?

The sudden and complete withdrawal of carbohydrates from the diet of a diabetic patient is known to be dangerous. It is followed by nausea, vomiting, loss of weight, and the odour of acetone in the breath, the presence of these acids in the urine, and a great increase in the amount of ammonia in the urine. Though the total amount of nitrogen is not altered, the ammonia is greatly increased. Signs of coma may also occur. In one case[1] it is recorded that the ammonia increased from 7 to 29 per cent., and that the blood also became less alkaline. Then the patient was given more carbohydrates, and these symptoms disappeared. A great improvement took place in the general condition of the patient, including the disappearance of the smell of acetone in the breath, and the diminution of the ferric chloride reaction of the urine, although there was no marked change in the amount of sugar excreted in the urine.

It is therefore clear that these bodies do not come from carbohydrates, because carbohydrates diminish the amount of them in the urine. Do they come from proteid, or from fat ? Both views have been held, but it is certain that proteid cannot be the main source, for their excretion is not accompanied by a proportionate increase in the excretion of nitrogen and sulphur. (M. Levy Satta.)

There remains the fat, and, as acetone is derived from the decomposition of a fatty acid, this would involve only a simple change.

Geelmuyden[2] and others produced acetonuria in healthy persons by a fatty diet. In one case, the sole diet, daily for five days, was 250 grams of butter, 200 grams of oil, and a little wine. As a result β-oxybutyric acid, diacetic acid and acetone were found in the urine in amounts such as only occur in the severest cases of diabetes. On the last day, these acids caused 37 per cent. of the total nitrogen to appear in the form of ammonia.

The Element of Starvation.—Anyone can produce acetonuria by starving himself. In some diseases associated with acetonuria, the element of starvation is obvious, for instance, in carcinoma of the digestive organs, certain febrile conditions, and in prolonged rectal feeding. A wasting diabetic is being starved also from inability to metabolise carbohydrate.

Of all the tissues, the fat loses most in starvation, the more noble organs being fed at the expense of the less essential ones. To effect this, the fat must be broken down, in the course of which fatty acids would be set free.

The Element of Defective Oxidation.—Oxygen starvation can produce a similar effect. Thus in mountain-sickness, in which deficiency of oxygen pressure is the exciting cause, acetonuria occurs. Oxygen starvation is obviously at work also in broncho-pneumonia.

Von Noorden[3] correlates these factors by referring the rôle of carbohydrates, in the prevention of acetonuria, to the relative abundance of oxygen they contain. In the complex changes, which occur in the metabolism of the tissues, this oxygen is drawn on to complete the breakdown into CO_2 and water. In its absence, these less completely oxidised fatty acids appear. That the acetonuria of febrile conditions could be largely inhibited by supplying the wasting tissues with carbohydrates, he proved as follows:—In two cases of typhoid fever, he gave patient A. a diet with very little carbohydrate in it, and patient B. one with plenty of carbohydrate. A. had a marked diacetic reaction, and B. only a trace of acetone. After a few days, the diet was reversed with the result that the former showed only a trace of acetone, and the latter a well-marked diacetic reaction.

Meyer[4] has made similar observations on children suffering from various acute infectious fevers.

I would suggest a slightly different and rather simpler way of regarding the matter.

Vernon,[5] as the result of recent experiments, thinks it probable that not only are the oxidation processes of the tissues carried out by non-nitrogenous groupings, but that these groupings are not even in chemical combination with proteid structure. Verworn had previously suggested that these are of a carbohydrate nature, and therefore, contain aldehyde groups.

From this, we can see that, in the absence of either sufficient oxygen, or of sufficient aldehyde groups, to which the oxygen could attach itself, defective oxidation of the tissues must occur. *Acetonuria, therefore, becomes a symptom of incomplete oxidation* due to interference with either factor.

Explanation of the Toxic Symptoms.—Are the symptoms produced by the fatty acids *per se,* or is the presence of these acids merely another symptom of perverted metabolism ?

The acids are not themselves directly toxic. Given to man or animals, they do not even produce acetonuria. But they might produce toxic results simply because they are acid, and thus upset the alkalinity of the blood,* diminishing its power of taking up CO_2, and leading to internal asphyxiation of the tissues. This will actually occur, if animals are repeatedly injected with acids, though carnivora have considerable power of neutralising the acids by producing ammonia from their proteids.

Though there is little doubt that, should acid intoxication definitely occur, it will aggravate the condition, some of the symptoms, associated with acetonuria, can occur without acidosis. In diabetic coma, the alkalinity of the blood can be greatly, and usually is, reduced, but this is not invariably the case. Thus whereas normal alkalinity varies from $\frac{N}{20}$ to $\frac{N}{30}$, in diabetic coma it may fall to $\frac{N}{90}$. But in coma, it may also be as high as $\frac{N}{35}$, while in diabetes without, it may be as low as $\frac{N}{45}$. The low percentage of CO_2 in the blood of comatose diabetics is probably the result of the dyspnœa which increases the lung ventilation.[6]

Moreover, acetonuria may be accompanied by great inequality of the toxic symptoms. Thus the acetonuria of fever is never so serious as that of diabetes or pregnancy. We must go a step further back, and seek a cause both for the acetonuria and the toxic symptoms, since the former is not necessarily the result of the latter.

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* Alkalinity is here used in the accepted sense of "titration alkalinity," which indicates the power of the blood to neutralise weak acids. In the strictest language of modern physical chemistry, blood is neutral, having no excess of hydroxyl atoms.

The Results of Autolysis.—To-day we have a much clearer idea of the way in which the nobler organs live on the others in starvation. When the food supply is insufficient for the needs of the organism, intracellular ferments come into action, setting up autolysis, or tissue degradation, the products of their action being utilised by the more essential organs.

Schryver[7] has shown that this autolysis proceeds much more rapidly in fasting than in well-fed tissues. In general, he regards the products of autolysis as falling into two groups, non-nitrogenous acid and amino bodies.

In well-nourished animals, the excess of ammonia, which is always present from proteid disintegration, will neutralise the acids, the resulting ammonium salts being converted by the liver into urea. But in starvation, the fats being chiefly drawn upon, the non-nitrogenous acid groups will be formed in excess. These will appear in the urine as oxybutyric and diacetic acids.

We know from Chittenden's[8] work that the amount of proteid, required for tissue building, is much smaller than was formerly believed. It seems quite likely that another function of proteid is the prevention of acid intoxication by the ammonia it gives rise to in its disintegration.

If this is inadequate, the acids produced by autolysis can throw the liver out of gear, and render it incapable of converting such ammonia as is formed into urea. Hence the excessive percentage of ammonia salts in the urine. As autolysis proceeds faster in acid than in alkali media, a vicious circle is established. Breaking down of fasting or oxygen-starved tissues produces acids, which, in their turn, produce further breaking down of the tissues. In this way, the wasting, which originally caused the acetonuria, may be accentuated by the acidosis. But acetonuria, as a symptom of tissue breaking down, may occur without acidosis, the protective ammonia formation being sufficient for neutralisation. When once it becomes insufficient, both acetonuria and acidosis will result.

To recapitulate, acetonuria is the result of increased metabolism of fat. This will occur in any starving tissue, but it is particularly apt to occur if oxidation is deficient, because then the final breaking down of the fat into water and CO_2 does not occur. Deprivation, or non-utilisation, of carbohydrates is specially likely to cause acetonuria both because the tissues are being starved, and because the process of oxidation is apparently closely connected with the carbohydrates. If the increased metabolism of fat is great enough to cause acid intoxication, the condition becomes much more serious. The liver is unable to convert ammonia salts into urea. The diminished alkalinity of the blood renders it incapable of taking up as much CO_2. CO_2 is therefore retained in the tissues, and internal asphyxiation results.

II.—SYMPTOMS ASSOCIATED WITH ACETONURIA.

(*a*) *In Diabetes.*—The cardinal symptoms have already been dealt with, when considering the effect on a diabetic of sudden deprivation of carbohydrates. But milder manifestations of this sort are not infrequent in the more amenable type of diabetes. If "bilious attacks," accompanied by some drowsiness occur, they will usually be found to be associated with the appearance of acetone and diacetic acid in the urine, though these bodies may have been previously absent.

(*b*) *In Recurrent Vomiting.*—In 1882, Dr. Gee[9] called attention to cases of fitful and recurrent vomiting of unknown causation in children. Later observers noted acetone in the breath, urine, and vomit. Diacetic acid and oxybutyric acid have also been found when looked for. The analysis of 55 cases by Batty Shaw and Tribe[10] gives the following clinical features. The cases usually occur between 3 and 11 years of age. The frequency of the attacks is very variable, a common interval being three months. There may be a prodromal period, in which dyspnœa, sighing respirations, offensive breath, choreic movements, and general restlessness have been noted. The tongue may either be coated or clean. Then vomiting begins, without nausea, and usually without gastric pain, all food is rejected, and, towards the end of the attack, bile appears, sometimes even blood. Constipation is common. The attacks may last only a few hours, but the average duration is five or six days. It is the rule for fever to occur during the attacks of vomiting. Wasting is often a very marked symptom. In later life, these attacks are sometimes replaced by migraine, but they tend to disappear when puberty is reached. Three of the fifty-five cases were fatal. A mild degree of such a condition is, I believe, quite common in children, and I would venture to suggest that "biliousness" which, as Dr. Gee says, is a real state, a very common state, but a state that is little understood, is really of this character also. Probably the liver is put out of work by some toxic substance absorbed from the intestine. This would explain why the prompt use of a mercurial purge may ward off an attack. When once the liver fails to do its work, the tissues are starved, and, in their autolysis, produce these abnormal acids.

(*c*) *In the Pernicious Vomiting of Pregnancy.*—It is now recognised that, though the pernicious vomiting of pregnancy may be due in some cases to mechanical causes, such as displacement of the uterus, and in others to neurotic causes, there remains a more serious group in which a toxæmia is responsible. It is never safe to refer the pernicious vomiting to mechanical or neurotic causes, unless toxæmia can be definitely excluded. In these toxæmic cases, necrosis and degeneration of the central portion of the liver lobule, and necrosis of the excretory portions of the kidney have been found. Whitridge Williams[11] found also a striking increase in the percentage of nitrogen, eliminated as ammonia, which, compared with the total nitrogen of the urine, amounted to 16 to 32 or 46 per cent., instead of the normal 3 to 5 per cent. The total output of nitrogen remained about the same in these cases. He suggested that this might be due either to failure of urea-formation in the liver, or to the attempt to neutralise acid intoxication. On the views here suggested, both these factors would play a part.

Dr. Helen Baldwin[12] found that, in such a case, the urine yielded a marked reaction for acetone and diacetic acid, but no sugar. The patient's condition was so serious that labour was induced. After this, the abnormal acids diminished, until only acetone was found. On the tenth day after the induction of labour, there was a return of severe headache, nausea, and vomiting, and it was noteworthy that, on this day, diacetic acid was again found in the urine. After this recovery was uninterrupted.

In phosphorus poisoning, there is a diminished oxidation going on in the liver, with the usual results. In pernicious vomiting, some toxin seems to produce a similar effect.

(*d*) *In Gastro-intestinal Acetonuria.*—As an example of the symptoms, I might mention the case of a lady, aged 24, who consulted me for rapid wasting with marked constipation and occasional vomiting. She only weighed 5 stone 6 lbs., and all the ordinary causes of wasting could be excluded. In a fortnight she had lost two pounds more. Diacetic acid was found in the urine, but no sugar or albumen. Then membranous casts were found in the stools. I ascertained that she had been taking an extraordinary diet—large quantities of beef-tea, mushrooms, and extractives of all sorts. There was very little nourishment in the diet, and an enormous amount of stimulating substances. The treatment was simply to give her a plain but liberal diet, with alkalies before meals, and twenty grains of citrate of potassium three times a day. The diacetic acid soon disappeared, and the patient rapidly gained weight—one stone in six weeks. My view is that membranous colitis had caused both the emaciation and the acid intoxication, and that the condition had been accentuated by faulty diet. I believe the case to have been one of gastro-intestinal acetonuria.[13]

(*e*) *In Broncho-pneumonia.*—Dr. Garrod[14] associates the symptoms of drowsiness, torpor, and vomiting with the presence of acetone and diacetic acid in the urine.

The principal symptoms then, which seem to be commonly associated with the various forms of acetonuria, are wasting, vomiting, drowsiness, and coma.

III.—ACETONURIA IN DELAYED CHLOROFORM POISONING.

We are now in a better position to consider this vexed question. That death might follow the delayed action of chloroform was first suggested, so long ago as 1850, by Casper, and then by Langenbach. In this country, Dr. Leonard Guthrie[15] drew attention to the condition in 1893, and, during the last two and a half years, much interest and discussion has been aroused on the subject. Other anæsthetics besides chloroform have produced the symptoms.

Twelve hours or so after the anæsthetic, the patient (usually a child) suffers from profuse and repeated vomiting, the vomiting eventually resembling the dregs of beef-tea. Sometimes there is a preliminary period of restless excitement and delirium.

This is followed by drowsiness, apathy, and unconsciousness, deepening to coma. Death usually occurs about the fifth day, but sometimes later, from cardiac or respiratory failure, gradual or sudden. Pyrexia is not marked, as a rule, though the temperature may be very high just before death. The pulse becomes very rapid. Albuminuria and the presence of casts in the urine are common. Furthermore, there is a smell of acetone in the breath, while acetone and diacetic acid are found in the urine. It will be noted that these symptoms resemble, in essentials, the features of other acetonurias. But the abnormal substances are only looked for, as a rule, after anæsthetics where something goes wrong. Routine examinations, therefore, are necessary before we can decide what weight can be attached to their presence in these cases. Such have been made, but the results are quite discordant.

Hubbard,[16] in 135 surgical cases, found acetone nine times, with diacetic acid four times. In another series of seven cases, acetone or diacetic acid was found, on being looked for to explain some irregularity in convalescence. Telford and Falconer[17] obtained the following results in their cases :—

	Acetone present.	Diacetic Acid present.
Pre-anæsthetic Examination :—	—	—
Non-septic cases (110) -	4·5 per cent.	7·3 per cent.
Septic cases (33) - -	36·4 ,,	30·4 ,,
Post-anæsthetic Examination :—		
1. Chloroform alone (38) -	92·1 ,,	84·2 ,,
2. Chloroform introduced by ethyl chloride (53).	88·6 ,,	81·1 ,,
3. Ethyl chloride alone (18).	83·3 ,,	66·6 ,,
4. Ether (9) - - -	88·8 ,,	77·7 ,,

On the other hand, in 1905, Mr. W. G. Ball, while House Surgeon at the Metropolitan Hospital, kindly examined for me, before and after the anæsthetic, the urines of all the cases operated on during a period of three months, without finding diacetic acid once. Recently he has repeated such examinations at St. Bartholomew's Hospital on 40 cases, in which various anæsthetics were employed, chloroform being the commonest. In no case was diacetic acid detected.

Such extraordinary discrepancies as exist between these results and those of Telford and Falconer, perhaps, depend on some difference in the method of administration. The difference in the experiences at different hospitals as to the frequency of post-anæsthetic poisoning may be due to a similar reason. High percentage of the anæsthetic vapour has, as Dudley Buxton[18] points out in this connection, a much more injurious effect upon protoplasm than a low one.

In any case, it must be conceded that acetone and diacetic acid appear frequently after anæsthetics without toxic symptoms.

The most striking change, noted *post-mortem*, is fatty degeneration of the liver, sometimes so intense as to give rise to a "canary yellow" appearance. Fatty degeneration has also been noted in the heart, kidneys, and gastric mucous membrane.

Guthrie thinks the microscopical appearance of the liver in this condition can be distinguished from other fatty degenerations of the organ, but this point is by no means clear. Two interpretations have been given :—

(i) The anæsthetic is the primary cause of the fatty degeneration (Stiles and MacDonald,[19] Carmichael and Beattie[20]).

(ii) The anæsthetic is merely the "last straw," causing a fatal result by acting on a previously fatty liver (Guthrie).

The great difficulty about the first view is that there is no relationship between the symptoms and the amount of anæsthetic employed. In the same patient, the anæsthetic may have been taken well on one occasion, while, on a second, a very much smaller amount has been fatal. Idiosyncrasy will hardly explain this.

It must be admitted that prolonged administration of chloroform can produce a fatty liver, but it is almost incredible that such small doses, as have sometimes caused the symptoms, can do this. In one recorded case, the liver could be felt three fingers' breadth below the costal margin, twenty-four hours after the administration of a small dose. This could hardly have been the direct result of the chloroform.

Guthrie's view is free from these difficulties. It explains why anæsthetics should be dangerous at one time and not at another, the element of danger being the superabundance of fat existing at the time of operation. He further suggests that the storage of superfluous fat may be due, in some cases, to the large quantity of cod-liver oil, and fattening diet, supplied to delicate, crippled, and rickety children, in the hope of strengthening them, coupled with lack of exercise.

It is important to recall that all anæsthetics are solvents of fat. The breaking down of such dissolved fats could give rise to excess of fatty acids, and thus to acetonuria. But the matter is not so simple as Guthrie's phrase, "Superabundance of fat," would imply. Dudley Buxton reminds us that many very fat people have been exposed to long administration of chloroform without any after-effects.

Why should fat in the liver behave so differently to fat in other parts?

Fat in the liver may be obvious as the result of sepsis, broncho-pneumonia, phthisis, rickets, profound anæmias, and phosphorus poisoning, to mention the most important conditions. But the amount of histologically demonstrable fat is not an accurate criterion of the total fat in an organ. Thus, as Leathes[21] points out, the fat of nerves does not react to staining reagents for fat if, by the use of fixing agents, they are prevented from undergoing the changes which they would otherwise slowly undergo in the presence of osmic acid. But degenerated nerves contain free fats, which can at once be demonstrated by any of the reagents for fat. In the same way, the total amount of fat normally present in the heart, kidneys, or liver does not give the characteristic reactions, or even yield to fatty solvents, while after degeneration it does so readily. Thus it happens that an obviously "fatty" organ sometimes actually contains less fat than normal.

Again, Rosenfeld has shown that "fatty degeneration" of the liver may be really due to transference of fat from other parts, the liver being apparently unable to deal with it when it gets there. Phosphorus, or diphtheria toxin, seems to act by retarding the normal reaction of the cells, probably by inhibiting the oxidases. The condition may be fairly called, as Leathes suggests, one of "fatty congestion."

The moral of all this is that more is implied in the term fatty liver, than fatty accumulation, which, indeed, may not occur at all. It implies that the vital reactions of the liver have been so altered that it can deal neither with its own fat, nor with the fat reaching it from elsewhere. Its own fat is now present in simple forms, which can be readily dissolved. The conclusion, to which we are led, is that, while anæsthetics may cause acetonuria as a result of excessive metabolism of fat in any part of the body, they will not cause toxic symptoms, unless the liver is thrown out of gear at the same time. A diseased liver will naturally be more easily affected than a sound one. A liver, which is not only diseased, but shows this by holding its fat in a simple soluble form, will be specially liable to post-anæsthetic poisoning.

IV.—TREATMENT OF ACETONURIA.

The indications for treatment are :—

(i) To prevent the further formation of these bodies so far as possible. Broadly speaking, this will be accomplished by diminishing the fat in the food, and by administering carbohydrates.

(ii) To break the vicious circle in autolysis, and combat acid intoxication by neutralising the acids already formed.

By what methods can we put these indications into practice ?

(*a*) *In diabetes*, it is no use pouring in carbohydrates which cannot be utilised. The difficulty has arisen from the failure to metabolise carbohydrate ; but this failure is seldom absolute. Thus lævulose can sometimes be metabolised up to 50 or 100 grammes a day, when dextrose cannot be dealt with at all. Von Noorden maintains that oatmeal gruel is tolerated, when other forms of carbohydrates are not. I have found that, in some cases, this is so for a time, though the sugar has subsequently returned. It is much easier to obtain and cheaper to employ. But his additional suggestion, to give a considerable quantity of butter with the oatmeal, does not appeal to me in view of the probable origin of these abnormal acids from fat. In order to neutralise these acids, sodium bicarbonate should be given with a free hand, whenever the ferric chloride reaction appears in the urine, until the urine becomes distinctly alkaline. I usually give citrate of potash as well as bicarbonate of soda, because it is not neutralised by the gastric juice, and it becomes bicarbonate in the blood, which is where the alkali is most needed. It can be given in 45-grain doses, and is particularly suitable in those milder cases of diabetic acetonuria, in which some drowsiness and "bilious" symptoms are present.

If, in spite of this, coma supervenes, at least a pint of 2 per cent. sodium bicarbonate solution made up in normal saline should be infused intravenously. Recently, I infused 30 ozs. in this way, with the result that consciousness returned for three hours. Unfortunately the coma then reasserted itself. This is the usual experience, for we cannot strike at the root of the mischief, and stop the autolytic ferments. But there are obvious advantages in even such a temporary rally, in which the reason, and the powers of recognition are restored.

I have tried rectal injections of sodium bicarbonate and lævulose, but not with any marked success. The total amount of alkali should not be more than about 1 ounce a day. Beyond this amount, it is thought to have a depressant action on the heart.

In a condition which, on theoretical grounds, we believe to be associated with deficient oxidation, to which the characteristic air hunger also points, inhalations of oxygen may reasonably be tried. But since the cell lacks oxygen because a link is missing, not much can be expected from them. And when all is said and done, it remains true that, in diabetic coma, "the duration of life is to be measured by hours rather than days."

(*b*) *In the Recurrent Vomiting of Children.*—To ward off attacks, prodromal signs should be noted—white stools, offensive breath, some change in complexion, usually indicative of what are called "bilious attacks," and the presence of abnormal acids in the urine—then mild aperients and easily digestible foods should be given. Barley water is usually tolerated. Small doses of grey powder, or calomel, should be given, also bicarbonate of soda, up to 3 drachms in the day. Normal salt solution per rectum is useful. I would suggest that arrowroot might be employed, on the principle that the abnormal acids are checked in their production, by the administration of carbohydrates.

(*c*) *In the Pernicious Vomiting of Pregnancy.*—Whitridge Williams recommends that, when the amount of nitrogen in the form of ammonia rises from the normal 3 or 5 to 10 per cent. of the total, labour should be induced. The condition of puerperal eclampsia differs from this, because the total amount of nitrogen excreted is diminished, and the proportion of ammonia remains constant. But some interesting observations by Longridge[22] suggest that the general line of treatment, which I have laid down, is applicable here also. He noticed a diminution of alkalinity of the blood in eclampsia, but he did not state whether this was due to the presence of diacetic acid. He gave citrates with the object of bringing up the diminished alkalinity of the blood to normal. As I have already said, I have found this method efficacious in the acid intoxication of diabetes. Another point of interest was that sugar was given by the mouth and rectum "in order to replace the glycogen in the liver, without which that organ could not exert its antitoxic function." I do not know what evidence we have that the liver cannot exert its antitoxic effect without glycogen. On the other hand, we know that carbohydrates have a distinct influence in preventing the production of these abnormal acids, and I would suggest that the sugar was effective for this reason.

(*d*) *In delayed Chloroform Poisoning.*—Guthrie suggests as a line of treatment (1) that before operation on even fat and apparently healthy children, careful inquiry should be made as to the history of so-called "bilious attacks," which may in reality be those of acidosis. (2) In all cases, in which over-fattening and want of exercise are suspected, operation should be delayed, if possible, till the patient has been subjected for some days to a fat-free diet. The urine should be examined for diacetic acid, and, if present, a course of alkalies should be prescribed. (3) Both starvation and fright cause acetonuria. He thinks that the four hours' fast for children before operation is too long. He recommends the giving of nutrient enemata, after the lower bowel has been cleared, two hours before and immediately after operation. The effect of fright cannot be altogether controlled, but may be combated by preventing starvation. Should symptoms of acid intoxication occur, despite these precautions, it must be treated as in other cases.

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CLINICAL NOTES UPON TESTING FOR SUGAR IN URINE.[1]

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CANE sugar (sucrose) does not occur in urine, except after ingestion of enormous quantities. It has sometimes been added to urine for purposes of deception. Such a urine would not directly respond to Trommer's test. The sugars that are met with clinically are :—

(I.) *Monoses* (Mono-saccharides), *i.e.*, a single molecule of carbohydrate.

(*a*) Pentoses (C_5), *e.g.*, $C_5H_{10}O_5$.

These have occasionally been observed in morphiophagists. Pentoses are not fermentable.

(*b*) Hexoses : (C_6), *e.g.*, $C_6H_{12}O_6$.

Glucose (an aldose). Dextro-gyrate.

Lævulose (a ketose). Lævo-gyrate.

(II.) *Bioses* (Di-saccharides) : (C_{12}), *i.e.*, two molecules of a monose doubled by condensation into a single molecule, *e.g.*, lactose, $C_{12}H_{22}O_{11} = 2\ C_6H_{12}O_6 - H_2O$.

Lactose occurs in the urine of early lactation, and maltose ($C_2H_{22}O_{11}$) has also been detected in urine.

Of all these sugars, the most important is glucose (dextrose), the sugar of ordinary diabetes mellitus.

Normal urine contains a minute trace of glucose, and, possibly, of other carbohydrates. These infinitesimal amounts are not detectable, except by special skill, and are of no clinical significance. Quantities of glucose, appreciable by simple tests, are always pathological, and it is necessary to be familiar with the methods of detecting it.

On the present occasion, I will not discuss the differential diagnosis between—

(*a*) Transient glycosuria, *i.e.*, temporary exaggeration of the normal amount of sugar in the urine, unattended by noteworthy symptoms ; and

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[1] This article represents the substance of demonstrations upon sugar-testing given in the wards of Sir P. Dun's Hospital from time to time.

(*b*) Persistent glycosuria, with the complex of symptoms known as diabetes mellitus.

A persistent saccharinity, over 2 per cent., certainly occurs only in true diabetes, but, of course, a lower percentage does not exclude diabetes. In diabetes mellitus, the proportion of sugar may vary from 1 per cent. to 8 per cent., or more; and as much as 2 lbs. weight of sugar may be excreted daily. The amount does not usually exceed about 4 per cent.

Compare this with the pathological excretion of albumen, which rarely rises to 2 per cent., and is commonly under 1 per cent.

The presence of even a small persisting excess of sugar in the urine is more significant evidence of faulty metabolism than the occurrence of slight albuminuria. It is less common, and its detection is sometimes attended by greater difficulties.

The positive and conclusive tests for glucose in urine are two in number:—

(1) The fermentation test with yeast (Dobson, 1779). This test reacts only with sugars containing C_6, C_9, or C_{12} in their molecule.

Pentoses are not directly fermentable.

(2) The phenyl-hydrazine test of E. Fischer (1890). This test is extraordinarily delicate, and requires care in its manipulation. It reacts with 0 005 per cent. ($\frac{1}{40}$ gr. per fl. oz.) of sugar, and it does not depend upon a reducing action. In order to identify a particular sugar, it is needful to determine the melting point of the yellow osazone crystals which are formed. Neither of these valuable tests can be speedily carried out, and for this and other reasons they are scarcely suitable for country or general practice.

In certain special cases of doubt or difficulty, they may be indispensable, but I will not now dwell upon them.

The tests in everyday use all depend upon the one principle, viz., reduction of a metallic oxide to a precipitate of a lower state of oxidation, and of a different colour.

Two classes of oxidisable (*i.e.*, reducing) substances occur in urine:—

(*a*) Very easily oxidised, *e.g.*, urinary pigments, and certain chromogens.

(*b*) Less easily oxidised, *e.g.*, glucose, and various other reducing substances.

In normal urines, the chief active reducing substance is creatinin, of which about 1 grm. is excreted daily, *i.e.*, in or about the same amount as that of uric acid, which likewise exercises slight reducing action. Their influence is often overestimated. Other reducing substances (pyrocatechin, hydroquinone) may be met with in urine, especially after ingestion of drugs belonging to the "aromatic" series. One such compound, glycuronic acid, is frequently met with, and has strong reducing action. In that curious condition of perverted metabolism, known as *alkaptonuria*, the urine is strongly reducing, owing to the presence of aromatic acids, viz., uroleucic acid and homogentisinic acid.

In addition to reducing power, every normal urine contains substances which are able :—

(*a*) To dissolve blue copper hydroxide in presence of an alkali ;

(*b*) To hold in solution yellow or red copper suboxide after reduction has occurred.

These substances are uric acid, creatinin, and salts of ammonia.

Bearing these facts in mind, it clearly follows that when *small* quantities of sugar are in question, a reduction test *per se* will give only presumptive evidence of sugar, and may require to be checked by another test.

It is a remarkable and important fact that *smaller* amounts of sugar are detectable in diabetic than in normal urine, to which glucose has been intentionally added. The explanation of this apparent anomaly is that, owing to the diabetic polyuria, there is a diminution in the proportion of the cuprous oxide-dissolving substances in respect to the reducing action of the sugar.

In diabetes, 0·2 per cent. oi sugar can, with care, be detected by Trommer's test, and 0·025 per cent. by Fehling's solution, whereas urine, to which 0·4 or even 0·5 per cent. of sugar has been artificially added, may fail to give a characteristic precipitate with Trommer's test. (Tappeiner, *Chemical Methods of Clinical Diagnosis*, 1898. Translated by

Dr. E. M'Weeney. This little book contains the best short account I have seen of the *rationale* of sugar-testing.)

In other words, the reducing action of glucose is, fortunately, greater than its capacity for re-dissolving precipitated suboxide of copper.

One point, in addition, may be mentioned. When there is the least doubt, it is not safe to trust to the examination of a single sample of urine taken at random. The reason of this is that the amount of sugar in the urine fluctuates at different periods of the 24 hours, owing to dietetic and other influences. It is advisable, then, either to secure a specimen of the mixed 24 hours' urine, or, at least, to test two specimens, one taken at bedtime, the other an hour or two after breakfast. I have known a case in which sugar did not occur in urine until after midday.

Albuminous urine dissolves, but does not reduce, the blue copper hydroxide, and forms a rich blue solution. A small amount of albumen does not sensibly interfere with the copper test, and need not be first removed as some text-books direct. I frequently test for albumen and sugar, using the one test-tube charge of urine. A large amount of albumen is, undoubtedly, prejudicial, and should be first got rid of by boiling, acidifying, and filtering.

The reason is that albumen contains sulphur, and, when heated with a caustic alkali, furnishes a little alkaline sulphide (KHS), which reacts with copper or bismuth salts, and yields a black precipitate of cupric or bismuth sulphide respectively, which introduces confusion, and may mask a slight precipitate of cuprous oxide.

Let us now consider the best methods of applying the two tests, which are simple and sufficient in almost all cases, if intelligently employed.

I refer to:—

(*a*) The copper tests. (Trommer, 1841; Fehling, 1848.)
(*b*) The bismuth test. (Böttger, 1857.)

It is a notable fact that these tests should maintain their value after the lapse of more than half a century, notwithstanding the many brilliant advances in organic chemistry.

In regard to Trommer's test, I wish to enter a protest against the loosely worded directions so often given.

Take, for example, the following from a well-known textbook of medicine :—

"To ʒi. of urine add a few drops of a dilute sulphate of copper solution, and then as much liquor potassæ as urine. On boiling, the copper is reduced, if sugar is present, forming the yellow or orange-red suboxide."

Or again :—

"Trommer's method consisted in adding a few drops of solution of cupric sulphate to the urine, and then excess of liquor potassæ."

Such directions are not sufficiently explicit, and court failure.

If Trommer's test is properly used, it will seldom be necessary to go beyond it, and I quite endorse Dr. Tyson's opinion, who says :—" In my own hands the old Trommer test gives great satisfaction" (*Pract. Exam. of Urine*, 2nd edit., 1878).

The truth is that, with one specimen of urine, a "few drops," say 4 or 5, of copper solution, will suffice, and in another case, an equal quantity of urine may require, say, 30 or 40 drops.

It is all a matter of so proportioning the addition of the copper sulphate as to secure the maximal precipitation of cuprous oxide with the minimal tendency to re-solution of the precipitate.

We must, in each individual case, add just so much copper sulphate that a little copper hydroxide remains over in suspension, *i.e.*, the urine is *slightly* over-saturated with copper hydroxide.

Under the influence of heat, sugar reduces rather more copper hydroxide than it can dissolve in the cold.

I have over and over confirmed the truth of Tappeiner's statement that, in a number of cases of slight glycosuria, distinct precipitation of suboxide may be obtained by very accurate saturation with copper sulphate.

The test-tube should be held up against a bright light, and the observer's eye must be trained to distinguish between the white flocculi of calcium and magnesium phosphates, unavoidably precipitated by the alkali, and the blue flocculi of copper hydroxide. The copper sulphate should *never* be added *before* the liquor potassæ.

The reagents needful for Trommer's and Böttger's tests are at the disposal of every medical man, wherever he may happen to be placed.

They are three in number.

(1) Liquor Potassæ, or, Liquor Sodæ; *not* Liquor Ammoniæ.

The Liquor Potassæ (*v.* Sodæ) should be kept in a *green*[1] glass bottle, and it is preferably made double strength, B.P.

(2) Solution of copper sulphate (10–20 grs. to ℥i.).

(3) Bismuth subnitrate (oxynitrate) of B.P.

Trommer's test. *Method*:—If the urine is of high sp. gr. (1030–40), take only 2 or 3 drops, and dilute with water. If the sp. gr. is low, take about ʒss., not more than ʒi. Next add one half as much, or even an equal volume, of the strong Liq. Potassæ.

This usually causes a white turbidity, or flocculent precipitate of Ca and Mg phosphates, which may be filtered off before proceeding further.

Now cautiously drop in the copper solution until a slight permanent blue precipitate of copper hydroxide is apparent.

Heat the upper stratum of the liquid just to boiling point, and let it stand.

A yellow or brick-red precipitate of copper suboxide (cuprous oxide), Cu_2O; or, of cuprous hydroxide $Cu_2(OH)_2$, indicates sugar, which robs cupric oxide of half of its oxygen.

The *rationale* of the test is as follows, and the student is recommended to verify the experiments until he thoroughly understands the reagents he is using:—

If diabetic urine is not at hand, add a trace of honey or treacle to normal urine.

(*a*) Copper sulphate and Liq. Potassæ, alone, give a pale-blue precipitate, but *not* a deep-blue solution.

$$CuSO_4 + 2KOH = \left\{\begin{matrix} K_2SO_4 \\ \text{soluble} \end{matrix}\right\} + \left\{\begin{matrix} Cu(OH)_2 \\ \text{blue ppt.} \end{matrix}\right\}$$

Boil for a minute or two, and note the *black* precipitate of anhydrous copper oxide, CuO. $Cu(OH)_2 = CuO + H_2O$.

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[1] The reason for this is not an optical one, but because white glass includes PbO, which is partially dissolved out by the caustic alkali, and, this in presence of albumen (often co-existent with sugar), reacts with the proteid sulphur, and gives a black precipitate of PbS, which may lead to confusion.

(*b*) In presence of sugar, the blue precipitate of copper hydroxide is dissolved, and forms a rich blue solution.

Non-production of a deep blue solution renders the presence of sugar improbable.

(*c*) Excess of copper sulphate (a common mistake) and continued boiling must be avoided, otherwise an embarrassing precipitate of brownish-black unreduced cupric oxide will be thrown down, as explained under (*a*).

(*d*) If, on the other hand, an insufficient amount of copper sulphate is added (also a common mistake) to a highly saccharine urine, reduction will occur, but no precipitate of cuprous oxide will appear. The liquid will become clear yellow, because cuprous oxide is soluble in an excess of sugar in presence of caustic alkali. I have known a severe case of diabetes to be overlooked, and the sugar escape detection, for this very reason that the sugar was present in large amount.

Fehling's solution (potassio-tartrate of copper) is usually purchased ready made. It is liable to spoil by long keeping. If Fehling's solution is available, the neatest and most accurate way of using it is as follows :—

In one test-tube boil about ʒi. of Fehling's solution. In a second test-tube boil ʒss. to ʒi. of the urine. Let them cool for a moment. Then float carefully (preferably by a pipette) the urine on the surface of the copper solution. The production of a yellow or reddish precipitate indicates sugar, and is clearly seen against the blue background of the copper solution.

If the "pellet" form of the test be used, the pellets should never be added directly to the urine, but should be completely dissolved in ʒi. of boiling water, and the urine floated on this solution as directed.

It is worth noting that Fehling's solution will be effectively reduced by saccharine urine at ordinary temperatures, without heat being applied, if sufficient time is allowed, *i.e.*, some hours. The effect of heat is simply to quicken the *velocity* of the reaction. The term velocity, in chemistry, signifies rate of material transformation of a substance.

If any doubt or difficulty arises as to the result of the copper test, I strongly advise recourse to the excellent and simple bismuth test of Böttger (1857).

Method.—To a small quantity of the urine, diluted if of high sp. gr., add an excess of Liq. Potassæ. Then drop in a knife-pointful of bismuth subnitrate, and boil for at least one or two minutes. A black precipitate (= metallic bismuth, or a suboxide) falls to the bottom of the test-tube in presence of sugar.

If the urine becomes dark brown upon being heated with alkali (Moore's test), dilute freely with water, and let it stand.

This is a simple and trustworthy confirmatory test for sugar, and is free from some of the fallacies of the copper test, for it does not react with uric acid, creatinin, pyrocatechin, or hydroquinone. Albumen, if present beyond mere traces, must first be removed by boiling, acidifying, again boiling, and filtering.

The reason is to avoid the possible formation of black sulphide of bismuth (Bi_2S_3), due to interaction of the alkali and the sulphur in the proteid, as explained under the copper test. The bismuth test is more delicate, if we use a solution known as Almén's, or Nylander's solution, which is an alkaline tartrate solution of bismuth, analogous to Fehling's solution. An excess of bismuth subnitrate is to be avoided in Böttger's test, for a small amount of black precipitate, mixed with an excess of unaltered white bismuth salt, will appear merely grey. Cascara, rhubarb, and senna in urine, which may lead to colouration of the precipitate in the bismuth test, are easily differentiated from sugar by simply floating a little Liq. Ammoniæ on the cold urine. A reddish ring appears at the junction, due to chrysophanic acid.

An intelligent use of the copper and bismuth tests precludes the necessity for resorting to other tests, such as picric acid, indigo, or safranin.

GOUTY GLYCOSURIA.

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THE relation between gout, and the mild, and also the severe conditions where sugar is found in the urine, has been known for years, and has been commented on by many writers. There appears to be some connection between the change in the metabolism, which results in the production of the gouty state of the system, and those conditions, which give rise to an excess of sugar in the blood, with its appearance as such in the urine. Still, the essential starting point of the primary chemical changes is, in both conditions, uncertain, in spite of the many advancements recently made in chemical pathology.

Gouty glycosuria is usually met with in the latter half of life, and the patients are often of a robust constitution, and with a tendency to the development of fat. It is said to be more common amongst males. With many patients, glycosuria has probably existed for years before some slight disturbance, such as the passing of an increased amount of water, has caused them to consult their medical attendant, and has led to an examination of the urine.

In the milder cases, glycosuria is often associated with some digestive incapacity for starchy foods, and we also know that gout is conditioned to a large extent by the improper elaboration of the food in the alimentary canal. Again, in many cases, it is associated, as is also gout, with inadequacy and indefinite congestive states of the liver. Although these cases may rapidly clear up under proper treatment, there is some danger, if they are not attended to, that they may progress, so that eventually a condition indistinguishable from true diabetes obtains.

Some of these mild cases show a certain alternation from the usual uratic condition of the gouty to one where there is sugar in the urine with amelioration of the gouty symptoms ; then a return to the uratic condition of the urine, and so on. If untreated, this pernicious habit may become permanent.

With glycosuria, as also with gout, the nervous element must be considered. Worry, business troubles, and mental overwork have much to do with the onset and the maintenance of the glycosuria of gouty patients. From these slight conditions, with a small amount of sugar in the urine, there is every possible grade to states indistinguishable from true diabetes.

We must not be misled by a slight reducing action of the urine. It is well known that substances, such as uric acid and creatinine, will cause some reduction of the copper salt. This is more likely to occur in a concentrated urine with a high specific gravity containing much urate. We must be on our guard to prevent mistakes, and, if necessary, other tests for the presence of sugar must be applied. In the milder cases of gouty glycosuria, it is very probable that the elaboration of sugar in the liver and the muscles is at fault. In gout, there is no doubt that the liver is not functioning normally, and it is easy to understand that liver cells, which apparently allow uric acid to pass through them without further elaboration, will also not do their duty with regard to the carbohydrate, and will permit more than small quantities to pass unchanged. When it is once in the general circulation, the sugar will act as a foreign body, and will be excreted by the kidneys.

Slight cases nearly always clear up on treatment, at least for the time. There is a tendency to recurrence, but, in many cases, it seems to make little difference to the general health of the patient. Cases of glycosuria are often associated with cardiac degenerative conditions in elderly people, where the arteries and the kidneys are also diseased. It is usually better, in the mild cases, not to tell the patient that he is passing sugar. Certainly to call it diabetes is not only to make an erroneous diagnosis, but often has a very bad effect, as it depresses the patient to think that he has developed a condition with such a bad outlook. We have all met gouty patients, who had been told years before that they had "diabetes," and who, when we examined them, had not a trace of sugar in the urine.

The above represents the milder cases. Intermediate cases occur where there may be some slight thirst, and perhaps some loss of weight, and where the amount of water may be increased. Under these conditions, the gouty signs and symptoms are usually better, due probably to the increased amount of water passing through the body. This is also noticed when the patient has never suffered from articular gout, but only from the irregular manifestations of the disease, such as excess of urates, migraine, neuritis, etc. As the prognosis, and the significance of the sugar, in these intermediate cases, often cause us anxiety, it is encouraging when we find the uratic condition of the water returning under treatment. As gouty people are liable to true diabetes, we often cannot be sure, in these cases, until treatment has been continued for a time, that we may not be dealing with this latter disease. The presence of an excess of urea will help us in forming an opinion, as it indicates a more pronounced change in the metabolism, but more than traces of β-oxybutyric acid and acetone are present only when the condition is such as to admit of no doubt, although here their estimation is useful, from the point of view of prognosis. Even when the state is indistinguishable from true diabetes, it is well to remember that the prognosis, as regards the duration of the disease, is not so bad as when it is independent of gout.

Treatment.—In ordinary gouty glycosuria, it is found that those things, which are bad for gouty states of the system, are also bad for the glycosuria, and, generally, it is not advisable to put the patient on anything approaching to a diabetic diet. The large amount of nitrogenous food is liable to make him worse. The treatment must vary in every case, as it depends on the general condition of the patient, on the way in which he has been affected by the gout, and also on the extent to which the disease has progressed, and interfered with the proper working of the circulatory and other organs. So that, in every case, the gouty element must be remembered, and efforts made to keep the digestive organs, the liver, and kidneys in as good working order as possible. The bowels must be kept well open so as to relieve any portal congestion, and saline aperients, with an occasional mercury pill, are indicated.

Alkaline treatment is very beneficial, and the citrates of soda, potash, and ammonia are useful. Ammonium phosphate is also good, and may be given in doses of 10 to 20 grains three times a day in plenty of water. Salicylate of soda is often very useful, but, if it has no effect after a couple of weeks' administration, it should be discontinued. Arsenic and cinchona may be given as tonics in order to improve the general state of the system.

As regards diet, the main point is to recommend one which can be easily absorbed, and which does not throw too much work on the digestive organs, and the liver. Simple meals, with a few articles at each meal, will generally suit best, and the proper cooking, and efficient mastication are of more importance than any detailed selection of the kind of food.

Sugar is best avoided, but it is often not advisable to limit the carbohydrates to any very great extent, and, in chronic cases, where there is some cachexia, the patients will often not gain weight when they are much restricted. White and brown bread, peas, beans, rice, macaroni, etc., may usually be allowed, with plenty of milk : and cream, if it does not disagree with the patient. Meat may be allowed once, and, in many cases, twice in the day.

Generally, our advice about the diet must have more reference to the gouty state than to the sugar in the urine. As with gout, the amount of fluid taken with the meals should be small, as digestion proceeds better when the gastric juice is not too much diluted. The patient should be encouraged to drink between meals. The less alcohol taken the better, but, in many cases, there is no objection to a small quantity of good whisky with the principal meal.

Exercise must be encouraged, and massage, baths, etc., are useful to keep the body in good condition. The urine should be frequently examined, and the treatment modified as the amount of the sugar lessens. In some of the mild cases, a few days' treatment may be sufficient to clear up the sugar.

Change of air and scene are at times necessary, as the patient thus gets away from his usual surroundings ; and those spas, in which there is an alkaline, or sulphurated alkaline, or a chlorinated and sulphurated water, are beneficial : such as Karlsbad, Neuenahr, Harrogate, Llandrindrod, etc. A sea voyage is often advisable, as a relief from letters and business worries is thus ensured.

In more severe cases, it may be necessary to recommend the passing of the winter in milder climates such as Southern Europe, or Egypt. In a few cases, in which the heart and the circulation are in good condition, a sunny bracing climate at a moderate altitude may be good. Although glycosuria in the gouty seems to indicate some further advance in the already defective metabolism, still, cases have been known to go on for fifteen or twenty years, and, generally, the prognosis is good.

ON THE ACTION OF CERTAIN DRUGS IN THE TREATMENT OF DIABETES MELLITUS AND CHRONIC GLYCOSURIA.

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Whilst the treatment of diabetes mellitus, by a restricted diet, is of the greatest importance, there can be no doubt, that, in some cases, drugs are also of service.

In drawing conclusions as to the value of drugs in diabetes, it is important to remember, that, in the mildest forms, variations occasionally occur in the sugar excretion, quite apart from treatment: also the occurrence of complications, such as febrile attacks, may cause the sugar excretion to be greatly diminished, or arrested for a short time; whilst other complications, such as phthisis, or nephritis, may cause the sugar excretion to cease during the last few weeks or months of life. Moreover, it is important to distinguish between the action of diet, and the action of the drugs. Hence treatment by drugs should not commence contemporaneously with the patient being placed on a rigid diet, if we wish to determine the action of the former. These sources of fallacy are often forgotten, and hence a large number of the drugs in the Pharmacopœia have been regarded, at different times, and by different medical men, as beneficial, or curative.

The following is a method of observation which appears to the writer to be suitable in investigating the action of any drug on the sugar excretion:—

It is best to *wait for a few days after the patient is admitted into the hospital before the observations are commenced*, since the change in the mode of life has often an effect, at first, on the sugar excretion.

The *diet* should be kept *the same throughout the whole period of observation;* otherwise changes in the sugar excretion are liable to be attributed to drugs, when they are really due to the altered diet.

This fixed diet may contain carbohydrates, albumen, and fat, in the usual proportion of an ordinary mixed diet: or the patient may be placed on a fixed diet, from which sugar, sweet food, and rice are excluded, but a definite amount of bread, or of bread and potatoes, may be allowed.

I. The patient is treated for one or two weeks, or longer, with a very small quantity of peppermint, or chloroform water which can have no effect on sugar excretion. The total sugar excretion is carefully determined daily during this period.

II. Then, for one or two weeks, or longer, a drug is given in place of the peppermint or chloroform water; the daily estimation of the sugar excretion is continued, and it is noted whether the sugar diminishes or not.

III. If there is the opportunity for continuing the observation for a longer period, the drug may be then discontinued, and replaced by a few drops of peppermint or chloroform water. It is noted whether the sugar excretion increases or not.

IV. If there is further opportunity for continuing the observations, the drug may then be given again, and the excretion of sugar watched, in order to determine whether it diminishes or not.

When these precautions are taken, when the patient is kept under the same conditions, and the diet unchanged throughout the whole period, and when only one alteration is made in this period, *i.e.*, the change as regards the drug, then we are able to draw fair conclusions as its action. If we find that, in the period when the patient is taking the drug, the sugar excretion is decidedly less than in the previous period (when only a little peppermint water was given), then there is a strong probability that the drug has been beneficial, provided that the sugar excretion was not diminishing spontaneously when the treatment was commenced, and provided that the conditions otherwise (as regards diet, mode of life, etc.) have been unaltered. Especially will this conclusion be very probable, if there is an increase of the sugar excretion when the patient returns to the peppermint water, and a decrease when he is again placed on the drug.

Before commencing the treatment of any case with drugs, it is important to determine the form of the disease, and to make a careful examination for various complications.

If we find that the disease is of the most severe form, and that the urine gives a deep brownish-red colouration (claret colour) with perchloride of iron, special care is necessary in the treatment. These cases will be considered at the end of this article.

If we find that a moderately restricted diet causes the sugar excretion to cease, no drug treatment is required. But, in the other cases, in which the sugar excretion cannot be arrested by diet, or can only be arrested by a most rigid diet, which the patient finds it difficult to tolerate for a lengthened period, drug treatment is desirable.

I. *Opium and its Alkaloids.*—In large doses, opium, morphia, and codeia have, in some cases, a beneficial action in diminishing the sugar excretion, especially in the milder forms of the disease. This may be due to the diminution of the appetite, caused by these drugs, since it has been shown that a diminution of the total amount of food is often beneficial. But, apart from such action, opium and its alkaloids may act beneficially in other ways.

In severe forms, these drugs often appear to be of little or no service, and they frequently cause most obstinate constipation. As constipation increases the tendency to diabetic coma, opium and its alkaloids do not appear to me to be suitable for administration in aggravated forms of the disease. I have tried heroin hydrochloride in a number of cases, since it is said that it does not cause constipation. Though it is not so liable as opium, morphia, and codeia to cause constipation, it has a slight tendency to produce this troublesome complication. I believe that, in some mild cases, it has a beneficial action, like codeia; but the drug should be given cautiously, since it occasionally produces unpleasant toxic symptoms.

II. *Salicylates and Aspirin.*—I have employed sodium-salicylate or aspirin in a large number of cases of diabetes, and have often found that these drugs are more satisfactory than opium and its alkaloids. In a large number of mild cases, the sugar excretion has clearly diminished whilst the patient has been taking these drugs, although the same diet has been maintained as had been given for weeks or months before the drug was commenced, *i.e.*, mixed ordinary diet, or slightly restricted diet. I believe that the records, in my cases, show clearly that salicylate of sodium and aspirin both have a definite action, in certain cases, and cause a diminution of the sugar excretion without producing injurious effects. The effects of the drugs requires to be watched; large doses are often necessary, but care should be taken to avoid toxic symptoms. Sodium salicylate may be commenced, in doses of 10 grains, given in peppermint or chloroform water, and rapidly increased, to gr. 15, three and then four times a day. I have sometimes given larger doses with good results, and without toxic symptoms being produced. But the patient should be seen frequently when very large doses are prescribed. The *natural* salicylate is less liable to cause toxic symptoms than the common artificial preparation.

Aspirin is less liable than sodium salicylate to produce toxic symptoms in large doses, and many patients take aspirin better than sodium salicylate. The aspirin may be given in powder form, in cachets, or in tabloids. It is best to commence with gr. 10, three times a day, and to increase to gr. 15 four times a day. I have sometimes given gr. 15 five times a day with advantage. A little water, with two drops of lemon juice, should be taken, just after, or along with, the dose of aspirin. It is important that alkalies (soda water, etc.) and milk should *not* be taken with, or just after, the aspirin. I have occasionally combined these two drugs, giving sodium salicylate three or four times a day and one dose of aspirin at night.

Bismuth salicylate often produces such obstinate constipation that it cannot be continued; but when cases are complicated with troublesome diarrhœa, bismuth salicylate is very useful.

The good effects of treatment with salicylates and aspirin are observed chiefly in the milder form of diabetes and, occasionally, in the severe forms in young people, they diminish or check the sugar excretion temporarily. But, in most of the severe forms, and especially in young people, they cause only a slight diminution of the sugar excretion, or none whatsoever. In these cases, however, the general condition often appears to improve under the action of the drugs. It is believed by some medical practitioners that salicylates and aspirin are most injurious in cardiac failure and in kidney affections. I have never seen any case of diabetes in which there was evidence that salicylates or aspirin had produced injurious effects owing to the presence of these complications. Nevertheless, it is best, on account of the opinion just mentioned, to withhold those drugs when the cases are complicated by cardiac failure, or nephritis; otherwise, any unfavourable course of the illness is liable to be attributed to their action.

Case 1. Woman, aged 70. Sugar excretion stationary for several years. Ordinary hospital diet, including bread, milk, and potatoes. No treatment for 8 days.

	Daily excretion of sugar, in grains.
1. ♏ 60 of peppermint water 3 times a day for 3 days. Sugar excretion on third day - - - - - -	1,540
2. Sodium salicylate, grs. 20, 3 times, and afterwards 4 times a day. At the end of 24 days, sugar excretion for 24 hours -	48
3. ♏ 4 of chloroform water 4 times a day; sodium salicylate discontinued. In 6 days the sugar excretion rose to -	1,152
4. Sodium salicylate given again, grs. 20, four times a day. In 6 days sugar excretion fell to - - - - -	39
5. During the next 14 days, grs. 15 of sodium salicylate, 4 times a day, sugar excretion - - - - - - - -	Trace only.

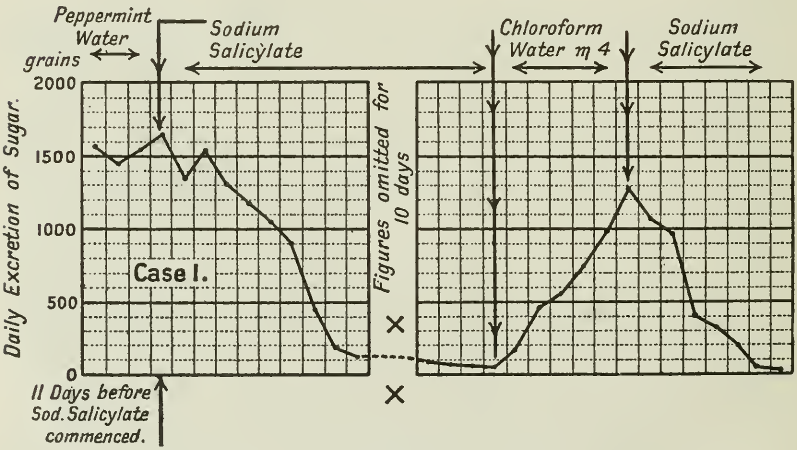


CHART 1.

The patient left the hospital feeling quite well, having gained weight. No complications had occurred. (*See* chart 1.)

Case 2. Woman, aged 52. Ordinary hospital diet, including 2 pints of milk and 11 ounces of white bread daily, but no potatoes, no rice, no sugar.

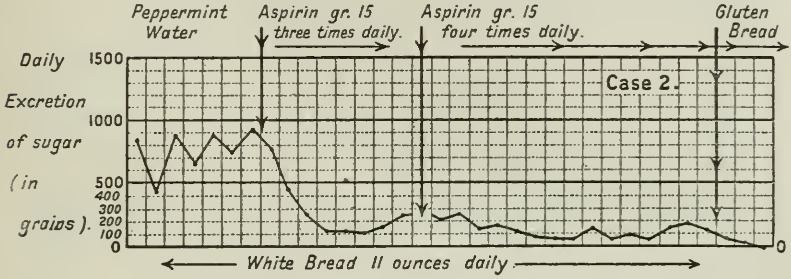
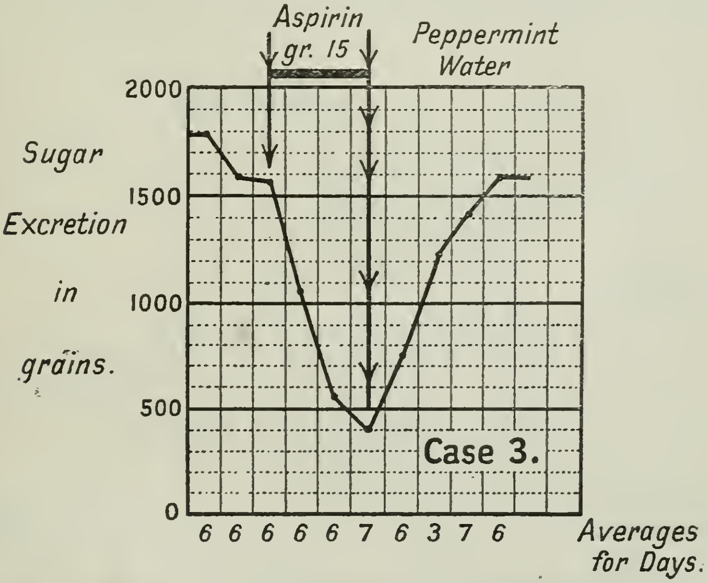


CHART 2.

No drug treatment for nearly 5 weeks, sugar excretion stationary. At the end of that time, the sugar excretion for 24 hours was 910 grains. Aspirin was then given, grs. 15, 3 times a day. In 4 days, the sugar excretion had diminished to 106 grains. At the end of nine days, the aspirin was increased to gr. 15, 4 times a day. The sugar excretion at the end of 15 days was 116 grains. The white bread was then replaced by gluten bread (5 ounces). In a few days, there was only the slightest reaction for sugar (less than 1 grain per ounce). (*See* chart 2.)

Case 3. Woman, aged 76 (apart from treatment, the sugar excretion had remained stationary for many years). Ordinary hospital diet, including



Sugar Excretion for 69 days.

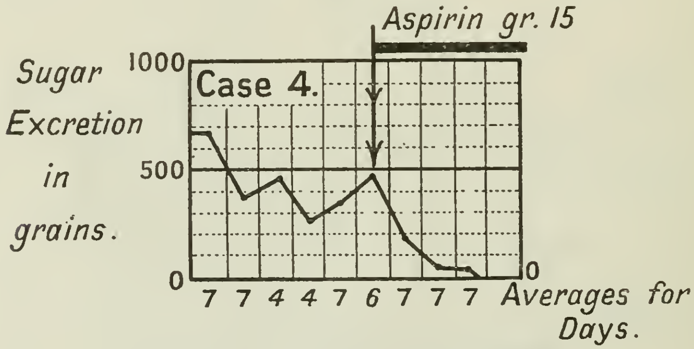
CHART 3.

white bread, but no sugar, no rice, no potatoes. Diet kept the same during the period of observation—69 days. No medical treatment for 10 days. Then the sugar excretion, during treatment, was as follows:—

Drugs.	Average daily excretion of sugar, in grains.
1. Peppermint water, ♏ 60, 3 times a day, for 6 days	1,799
2. Salol, grs. 5, 3 times a day for 6 days	1,594
3. „ „ 4 „ „ „ 6 „	1,564
4. Aspirin, grs. 15, 4 times a day for 6 days	1,088
5. „ „ „ „ 6 „	584
6. „ „ „ „ 7 „	402
7. Peppermint water, for 6 days (aspirin discontinued)	759
8. „ „ 3 „	1,218
(Figures omitted for 7 days.)	
9. Peppermint water for 6 days	1,586

The aspirin caused a reduction in the sugar from 1564 to 402 grains daily. When the aspirin was discontinued, the sugar excretion increased up to 1,586 grains. (The chart shows the excretion during 59 out of the 69 days of observation.)

Case 4. Woman aged 66. Urine, sp. gr. 1040, sugar, 25 grains to the ounce. No diacetic acid. Amount of urine, 52 ounces in 24 hours. Ordinary hospital diet, including white bread, potatoes, and rice pudding. But no sugar allowed. Diet kept the same throughout period of observation—60 days. For 4 days after admission to the hospital, no treatment.



Sugar Excretion for 60 days.

CHART 4.

Drugs.	Average daily sugar excretion, in grains.
1. Peppermint water, ♏ 60, 3 times a day for 7 days	688
2. Camphor, grs. 2, 3 times a day for 7 days	363
3. „ „ 4 „ „ „ 4 „	437

Drugs.	Average daily sugar excretion, in grains.
4. Salol, grs. 5, 3 times a day for 4 days	235
5. ,, ,, 4 ,, ,, 7 ,,	325
6. ,, ,, 5 ,, ,, 6 ,,	462
7. Aspirin, grs. 15, 4 times a day for 7 days	180
8. ,, ,, ,, ,, ,, 7 ,,	43
9. ,, ,, ,, ,, ,, 4 ,,	30

The urine then became quite free from sugar. (The chart shows the sugar excretion for 56 out of the 60 days of observation.)

Case 5. Woman, aged 65. Ordinary hospital diet, including bread and milk in usual quantities, but no sugar, no rice, no potatoes (these had not been taken for years).

Drugs.	Daily excretion of sugar, in grains.
1. For 10 days, peppermint water, sugar excretion (based on figures for last six days of this period)	2,335
2. Aspirin for 16 days, grs. 10, twice a day, increased up to grs. 15, 6 times a day. Latter dose given for 7 days. Average sugar excretion in this period	1,202
3. Peppermint water for 7 days. Aspirin discontinued. At the end of that period, sugar excretion	2,064
4. Small doses of other drugs tried without benefit for 8 days. At the end of that pertod sugar excretion was	2,112
5. Aspirin, grs. 15, 6 times a day—	
At the end of 18 days, sugar excretion was	585
At the end of 21 days	348

Similar results obtained on several occasions.

Case 6. Woman, aged 48. Ordinary hospital diet, including usual amount of bread, milk, rice, and potatoes.

Drugs.	Sugar excretion daily, in grains.
1. For 6 days, peppermint water, ♏ 10, 3 times a day. At the end of this period, sugar excretion	1,584
2. Small doses of antipyrin, then of urotropin, for 17 days. Sugar excretion at the end of this period	2,375
3. Aspirin given in small quantities, and increased in 7 days up to grs. 15, 5 times a day. Sugar excretion then	1,200
4. Aspirin continued; in 11 days, sugar excretion	Trace only.
5. Patient left the hospital, and discontinued the aspirin. Returned in 2 weeks, urine loaded with sugar.	
6. Aspirin prescribed; sugar again disappeared from the urine.	

This case is interesting, because for 23 days before the aspirin was commenced there had been no decrease in the sugar excretion.

Case 7. Woman, aged 73. Ordinary hospital diet, including bread, milk, potatoes, and rice pudding.

	Sugar excretion, in grains.
1. Peppermint water for 4 days. At the end of that time, sugar excretion for 24 hours - - - - - -	1,780
2. Aspirin, dose increased up to grs. 15, 5 times a day. Continued on this dose for 13 days; sugar excretion at the end of this time - - - - - - - - -	732
3. Peppermint water given, and aspirin discontinued; sugar excretion at the end of 8 days - - - - -	2,880

Later, similar result obtained.

In numerous other cases of the milder forms of diabetes, I have obtained marked diminution of the sugar excretion under the use of sodium salicylate, or aspirin, and in many cases the urine has become free from sugar.* These were chiefly private patients, but it is not possible to say, in some of the cases, that the improvement was entirely due to the drug. In many of them, the treatment has been discontinued, and the mode of life entirely changed, and the sugar has returned. But, with care, it is possible to keep the sugar from returning or to keep it down to a trace. Thus, in the case of a man, aged 56, the urine had a specific gravity of 1033, and contained 29 grains of sugar per ounce. Under treatment with sodium salicylate, the sugar steadily diminished, and, in seven weeks, it had disappeared. The man felt quite well, and had gained 1 stone 2 pounds in weight. Eight years have now elapsed. The urine has been examined almost every week up to the present time. On many occasions (10 or 15 times in the year) sugar has returned in very small quantities; but it has always disappeared rapidly when sodium salicylate, or aspirin, has been given for a short time. A week ago, the urine was free from sugar, and the man was in good health.

The cases, which I have recorded, have been mild forms of diabetes, or forms of medium severity, and it is in such cases, that salicylate and aspirin give the best results. But, occasionally, in severe forms, in young people, good results are obtained.

In three cases of severe diabetes, in patients aged 18, 21, and 28 respectively, the sugar excretion has ceased under treatment with sodium salicylate; but in two, after a few months, the symptoms returned. In the third case, I do not know the further course.

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* *See British Med. Journ.*, March 30, 1901, and December 27, 1902; *Med. Chron.*, August 1901 and May 1906.

In the patient, aged 18 (female), the amount of urine for the 24 hours was 132 ozs.; specific gravity, 1036; total sugar excretion, 3,960 grains. The treatment prescribed was sodium salicylate, gr. 15, four times a day. The sugar excretion steadily diminished. In 32 days, the urine was free from sugar. The patient remained in hospital for another month; the sugar did not return in the urine. The patient had gained 1 stone 3 pounds in weight.

She then returned home, and continued the sodium salicylate. The urine remained free from sugar for two months longer. Then she returned to her work, and soon a trace of sugar appeared in the urine. (For three months the urine had been free from sugar.) The sugar increased, in spite of treatment, for a few weeks as an out-patient. I do not know the further history of this case.

In this case the diet was also restricted. She was allowed 3 pints of milk daily, with a little bread, but was not allowed potatoes, rice, or sugar. As the restriction in diet was commenced at the same time as the sodium salicylate, it is not possible to say with certainty that the good results were entirely due to sodium salicylate, although this appeared probable.

III. *Alkalies.*—In the severe forms of diabetes, when the perchloride of reaction for diacetic acid first appears in the urine, I have tried the action of many drugs, and of changes in diet, with the object of causing this reaction to disappear, since usually there is much less risk of diabetic coma developing, if the urine can be kept free from this acid. I have not been able to find any drug which will invariably produce the effect; but I have often seen the diacetic acid disappear, when the bowels have become more regular through the action of purgatives, such as repeated small doses of calomel, or hydrargyrum cum cretâ, alone, or with the alkaline treatment (sodium bicarbonate). In several cases, I have seen the diacetic acid disappear after the patient has been treated with glycerine or bicarbonate of soda alone. But, in other cases, the diacetic acid reaction has persisted in the urine in spite of the administration of the drugs mentioned.

When the diacetic acid reaction is marked, the drugs mentioned, or changes in diet, usually do not cause the reaction to disappear. An alkaline treatment may then be of temporary service, by improving the general condition and postponing the onset of diabetic coma. I have treated many cases with large doses of bicarbonate of soda, as recommended by

Naunyn, with beneficial results. I have often seen marked improvement in the general condition, and *gain in weight*, in cases in which the patient appeared to be rapidly becoming worse, and approaching diabetic coma, although this treatment has had no effect on the sugar excretion.

I have given the bicarbonate of soda, in frequent doses of 30 or 60 grains, in soda water or in milk. The total amount of sodium bicarbonate taken in the 24 hours has often been from half an ounce to one ounce, or more ccording to the severity of the case ; and when there have been premonitory symptoms of commencing coma, I have often given 1½ ounces for a few days.

In cases in which diabetic coma has commenced, the symptoms sometimes subside when the large doses of sodium bicarbonate are given. Of course, the proportion of successful to unsuccessful cases is small. I have had a number of these successful cases, the patients recovering from the coma, and living for weeks or months (five weeks, ten weeks, two months, three months, six months). But there has always been a recurrence of the coma at a later date, or death has occurred from some other complication. The successful cases have been mostly those which have not been treated with sodium bicarbonate previously.

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THE TREATMENT OF DIABETES MELLITUS BY DRUGS.

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So long as we have no precise knowledge of the ætiology and pathology of diabetes mellitus, our therapeutic efforts must be chiefly concerned with the signs and symptoms which constitute the clinical picture. The value of a drug will be determined by the extent to which it is capable of modifying, or removing the sign or symptom against which it is directed, due regard being had to its influence on the course of the disease as a whole. The most prominent and constant feature of diabetes is the glycosuria, with its attendant polydipsia and polyuria. In the later stages of the condition, while not losing sight of the glycosuria, we must recognise the presence in the urine of the acetone series of bodies as a warning signal of the danger of the development of acidosis and diabetic coma. It is probable, also, that during the course of the illness, certain symptoms or complications may call for direct treatment.

In diabetes, drugs may be required—

(1) To control glycosuria.
(2) To avert or remove coma.
(3) To relieve symptoms and complications.

Treatment of the Glycosuria.—In attempting to determine the anti-glycosuric value of a drug, it must not be forgotten that the quantity of sugar, passed by a diabetic, is not constant from day to day, even in the absence of any dietetic alteration. Consequently, observations should be made extending over several days. Further, no alteration should be made in the patient's diet, coincident with the administration of the medicine. It is manifest that, if the carbohydrate intake is diminished at the same time that a drug is exhibited, there will be a reduction in the glycosuria. This reduction in the past has been frequently attributed to the medicament instead of to the alteration in diet, and so drugs have had assigned to them sugar-reducing properties of which they are entirely devoid. Finally, there should be no alteration in the habits, mode of life, or general surroundings of a patient during the days that he is under special treatment. These conditions cannot be obtained among extern patients, and therefore, if our results are to be relied on, observations must be made on patients in hospital. Even with hospital cases, a rigid dietary, continued for long, becomes irksome, and the daily consumption of a constant and definite quantity of food is at times difficult, and at times unsatisfying; so that for protracted observations one must rely on an accurate record of the amount of each article eaten. The actual carbohydrate contents of each kind of food having been determined by analysis, the total consumption of carbohydrates on each day becomes a matter of arithmetic.

The drugs, which have been tried in the treatment of diabetes, are almost innumerable. The majority, having been weighed in the balance of experience and found wanting, have disappeared into a forgotten past. Of the survivors, some have a good, and others a doubtful reputation. In recent literature, there is no more painstaking investigation into the anti-glycosuric value of certain drugs than the paper by Dr. Martin Kaufmann, entitled "Über die Einwirkung von Medicamenten auf die Glykosurie der Diabetiker."[1] His observations were made on patients in the hospital at Frankfort-on-Main, admitted under Professor von Noorden's care. The paper is remarkable, not only for the large amount of original work which it contains, but also for the laborious analysis of the literature which it discloses. Many of the statements and references, contained in this article, are based on Kaufmann's monograph. No attempt will be made to enumerate all the reputed remedies; a few only of the more usual will be discussed.

Opium and its Alkaloids.—If there be any drug to which is unanimously assigned anti-glycosuric properties, it is opium. It has been in use for over 100 years, and is still, of sugar-reducing drugs, the most to be relied upon that we have. It can temporarily control the excessive hunger, the thirst, and the polyuria. McGregor,[2] writing in 1837, reports two cases of diabetes which he treated with very large doses of opium. To one patient he gave 60 grains, and to the other 90 grains in the day. Both cases improved, but, on withdrawing the opium, the symptoms recurred. Pavy,[3] in an investigation which he made, in 1869, into the action of opium and its derivatives in the treatment of diabetes, found it possible to bring about a profound diminution in the sugar output by giving opium in gradually increasing doses up to 9 grains three times a day. Kaufmann[1] has carefully observed the action of opium in twelve cases. The ages of the patients varied from seven to sixty-five years. The preparation generally used was the extract, and the dose per diem was from ½ to 5½ grains. Of the twelve cases, a definite diminution in the glycosuria took place in six, a slight lessening in two, complete failure in two, and from the remaining two, no conclusion could be drawn. In two of the improved cases, the amount of acetone was also diminished. The action of the opium was most striking in cases, in which a rigid diet had failed to prevent glycosuria, as, if opium were then exhibited, sugar entirely disappeared, or became greatly diminished. Von Noorden[4] also holds that it is in such cases that opium gives the best results, and that it is practically useless administering opium, while the diabetic is allowed carbohydrates freely. Unfortunately, the improvement due to opium is often shortlived, and disappears soon after the withdrawal of the drug. In Kaufmann's most encouraging case, death occurred six months later from diabetic coma.

The mode of action of opium is obscure. Some attribute the improvement to its sedative influence on the nervous system; others, to a general diminution in the activity of metabolism.

Frerichs explains its results by its direct action on the glycogenic function of the liver, and von Noorden suggests that it may depress, or cut off, the nervous components of glycosuria, so that the alimentary component of the diabetic disturbance alone remains.

Frerichs and Schnée[5] object to the use of opium, and it must be admitted that, although diabetics bear opium extraordinarily well, it does at times produce sleepiness and constipation, and there is the danger of an opium habit being established. Recognising these objections, Pavy investigated, in 1869, the action of codeine, and reported successful cases. Writing in 1906, that is, after over 30 years' further experience in the treatment of diabetes, he[6] refers to his results with opium, morphia, and codeina, and states: "of the three, I was led to consider that codeina, in view of all the circumstances, constituted the most advantageous for remedial employment in the disease. This opinion, I may say, my subsequent experience has confirmed."

Von Noorden[4] agrees with Pavy that, as an antiglycosuric, as good results can be obtained with codeine as with opium. Saundby,[7] on the contrary, writes, "Codeine, even when given in much larger doses than are suggested by its principal advocate, is comparatively inert." He holds that, in opium, we possess the most valuable drug for dealing with this condition. Osler[8] states that, from the administration of codeine, not much effect is noticed, unless the patient is on a rigid diet.

Bromide of Potassium.—This drug appears to have been first used in the treatment of diabetes by Begbie, who, in 1866, found that sugar entirely disappeared from the urine after administering it in doses of 15 grains, three times a day. Subsequent writers have not been able to obtain equally good results. Osler,[8] however, regards it as often a useful adjunct, and von Noorden recommends it in glycosuria in highly neurotic individuals.

Salicylic Acid and Aspirin.—To Ebstein belongs the credit of introducing the use of salicylic acid as an antiglycosuric. His results were in general good, and he often secured a marked diminution in the elimination of sugar. Several German investigators confirmed Ebstein's statements. Kaufmann treated twenty-nine cases with salicylic acid, or its preparations. In the majority, aspirin was used, as he found it much less liable to produce unpleasant symptoms. He divides his patients into two groups—mild and severe cases. In over 70 per cent. of the former group, he was able to determine a marked diminution in the glycosuria. In some patients, the sugar entirely disappeared for a time. In the latter group, on the contrary, he obtained practically only negative results, a distinct improvement in the amount of sugar not occurring in more than 12 per cent.

The dose of aspirin varied from 45 to 60 grains per diem, and never gave rise to any unpleasant effects. It had, further, the advantage not only of reducing the sugar, but also of relieving neuralgia and pruritus. The sole contraindication to its use, mentioned by Kaufmann, is coincident nephritis.

Williamson[9] has treated eleven cases with aspirin. He found that, in four severe cases, the drug had no influence. In three patients, with chronic glycosuria, the sugar ceased, and, in four cases of mild diabetes, the sugar was diminished.

It must not be forgotten that all salicylic acid preparations give, with ferric chloride, a reaction somewhat similar to aceto-acetic acid.

Antipyrin has been administered in doses of 15 grains three times a day. It is doubtful that it has any antiglycosuric properties, and, as it appears in the urine as a lævogyrate substance, it necessitates a polarimetric observation, both before and after fermentation. Kaufmann is of the opinion that it should not be used for more than twelve successive days, as it is liable to produce albuminuria. The occasional diminution in the sugar output, observed by Kaufmann in a few of the cases he investigated, is attributed by him to gastric disturbance, leading to the consumption of a smaller quantity of carbohydrates. Antipyrin is eliminated by the kidneys, and gives a colour reaction with ferric chloride.

Syzygium Jambulanum.—Von Noorden[4] has satisfied himself that the fruit of this East Indian plant has, in some cases of diabetes, a marked effect on the glycosuria. He uses it for three or four weeks at a time, and has been able to temporarily increase the power of assimilating carbohydrates.

Uranium Nitrate.—In 1895 and 1896, West[10] reported some cases of diabetes, in which a great diminution in the elimination of sugar followed on the administration of uranium nitrate. It was given in gradually increasing doses till twenty grains, thrice daily, were reached. Writing a year later, Duncan expressed the opinion that the cause of the partial failure of this remedy in diabetes was insufficiency of dosage. It should be administered in quantities of twelve to fifteen grains three times a day after food.

Von Noorden regards it as of no practical value, an opinion which my own experience confirms. I have not, however, pressed the dose above eighteen grains daily.

The "vin urané Pesqui" has proved of no service in my hands, either as an antiglycosuric, or preventive of coma.

Alkalies, though invaluable for other purposes in diabetes, have no antiglycosuric properties.

Carlsbad Water.—Recognising the undoubted benefit, which diabetics derive from a visit to Carlsbad, Vichy, or Neuenahr, physicians have attempted to determine whether the bottled waters have any direct action on the elimination of sugar. Kretchy, Külz, Riess, and others found them useless. More recently, Kaufmann, as the result of four detailed investigations, arrived at the same conclusion.

II.—THE PROPHYLAXIS AND TREATMENT OF DIABETIC COMA.

The urine of diabetics should be examined, as a routine practice, with ferric chloride. If a positive reaction is obtained, the condition, described by Naunyn as "acidosis," is threatening. Confirmation of the presence of this danger is afforded by an examination of the amount of ammonia in the urine. For this purpose, the urine is collected for twenty-four hours, as aseptically as possible, so as to diminish the risk of bacterial decomposition. During the time of collecting, the urine should be kept at a low temperature, *e.g.*, by standing on ice, for the same reason. In health, the average amount of ammonia, eliminated in twenty-four hours, varies ·5 to 1 gram. As the organic acids are forming in the system, they demand increasing quantities of ammonia for their neutralisation, and consequently the amount of ammonia in the urine may be taken as a measure of the extent to which acidosis is present. The estimation of the ammonia requires the resources of a laboratory. Fortunately, from a therapeutical point of view, it is not essential. Any practitioner can add a few drops of a solution of ferric chloride to the urine, and the development of a positive reaction indicates the necessity for the immediate administration of alkalies. The initial dose should be from 150 to 200 grains of bicarbonate of soda daily. Mohr[12] suggests that a portion of the bicarbonate may be replaced by sodium citrate, particularly in cases which have a tendency to constipation. He gives 75 grains of sodium citrate dissolved in half a pint of warm or cold water. This is taken early in the morning, and, during the day, the patient drinks a bottle of Fachinger, or Vichy-Celestin water, in which have been dissolved 150 grains of the bicarbonate. The disappearance of the red reaction, the urine becoming alkaline, or the subsidence of the ammonia to 1 gram in twenty-four hours affords an indication for the withdrawal of the alkali.

The condition of the bowels demands special care when acidosis is threatening. Constipation must be guarded against by the administration of a more active purgative if sodium citrate fails.

Treatment of Diabetic Coma.—The measures described above, by controlling the dangers of acid intoxication, often postpone diabetic coma for a long time. When it comes, the treatment is on similar, but more active, lines. There is not much time to be lost, so Naunyn has advised the *intravenous* injection of from 500 to 600 grains of carbonate of soda, dissolved in 35 ounces of water. This solution must not be injected under the skin as, owing to its alkalinity, it is liable to produce gangrene. Herter[13] considers that the best treatment consists in making daily one or two intravenous infusions of a 2 per cent. solution of sodium bicarbonate in a ·6 per cent. solution of sodium chloride. The quantity introduced should be 1 or 1½ litres at each infusion. At the same time, large doses of the bicarbonate should be administered by the mouth, and the bowels should be freely opened. By active measures, such as these, consciousness is not uncommonly restored. In most cases, unfortunately, the improvement is only a matter of hours, and the patient again lapses into coma, which deepens till death closes the scene.

III.—TREATMENT OF SYMPTOMS AND COMPLICATIONS.

Thirst.—The reduction of the glycosuria is the best method for relieving thirst. It is useless to attempt restricting the amount of fluid, but sucking pieces of lemon, or sipping very hot water may relieve the demand. (Saundby[14].)

Constipation.—Any laxative, which does not contain sugar, is admissible. The convenient and, probably on the whole, the most suitable purgatives are the saline aperient waters, of which there is a great variety available.

Œdema is of very rare occurrence. Von Noorden has met it in patients carrying out his "oatmeal cure." He has seen it disappear after a dose or two of diuretin. As a rule, a rest in bed for a day or two suffices.

Pruritus.—This is one of the most troublesome and worrying complications of diabetes, and must be guarded against by the most absolute cleanliness. Frequent bathing with a solution of borax, or boracic acid, is indispensable. This should be followed by the application of a dusting powder, or a greasy ointment may be smeared over the parts.

The mouth must be carefully looked after, as dental caries and inflammation of the gums are easily set up. Alkaline and antiseptic mouth washes are useful in guarding against this complication.

Profuse sweating is not common in diabetics. It is rarely so excessive as to require treatment, and can be combated by the usual anhydrotic drugs.

Neuralgia and Neuritis.—The pain will be relieved by local anodyne applications, and the internal administration of antipyrin or aspirin.

SUMMARY.

(1) There is no specific treatment for diabetes.

(2) Drugs play at best only a subsidiary part in diabetic therapeutics.

(3) Opium is the best antiglycosuric drug at present available. It may be administered in any stage of diabetes, but is most useful in severe cases, in which a rigid diet fails to remove all sugar from the urine. Dose, 1—5 grains of the extract.

(4) Sodium salicylate and aspirin are valuable in mild cases of diabetes, and may temporarily completely remove glycosurin. Dose, 15 grains three times a day.

(5) Jambul may be used as an alternative to sodium salicylate or aspirin.

(6) A positive ferric chloride reaction indicates the daily

administration of bicarbonate of soda in doses of 150 grains and upwards.

(7) The intravenuous injection of 35 ounces of a 3 to 4 per cent. solution of *carbonate* of soda affords the best chance of restoring consciousness in diabetic coma.

(8) Constipation should be guarded against in all stages of diabetes.

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GLYCOSURIA AND LIFE INSURANCE.

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DIABETES viewed from the standpoint of life insurance may conveniently be considered under two headings:—

(*a*) The best means of establishing the presence of glucose (glycosuria) in the urine; (*b*) the significance attaching to sugar in the urine from the point of view of prognosis.

The reduction of copper hydrate, as exemplified by either Trommer's or Fehling's test, is the first and best means of detecting sugar in urine. There are, however, certain fallacies connected with its use. There are carbohydrates other than glucose, rarely occurring in the urine, which reduce copper: these are maltose, lævulose, lactose, and pentose.

Uric acid, kreatinin, hippuric acid, and combinations of glycuronic acid can reduce copper, though much less completely than can sugar. Certain drugs may give rise to products (probably combinations with glycuronic acid) which reduce copper, such are:—chloral, chloroform, morphine, sulphonal, salol, salicyclic acid, turpentine, acetanilide, phenacetin. It is only the sugars, however, which give the typical reaction with copper, it is only with them that the yellow cuprous hydrate forms quickly and in abundance, as the boiling point approaches, and changes rapidly into the brick-red cuprous oxide. If the reduction of the copper is not typical—if the precipitate is of a dirty greenish tinge, or only appears after boiling half a minute or more; or if, again, the red precipitate of cuprous oxide only appears in small amount, after the test tube has been standing, then there is doubt whether a small quantity of sugar is present, or one of the other reducing agents mentioned above. This dubious reaction with copper is liable to occur with concentrated dark coloured urines, and it should be a rule to dilute such urines before applying the copper test.

The copper test then may show that there is some reducing agent present, but leave it doubtful, whether (1) that agent is a sugar or not, or (2) being a sugar, whether it is glucose, lactose, lævulose, or pentose. Further tests should then be employed as follows:—

The fermentation test is performed as follows :—See that the urine is acid, boil it for five minutes to drive off any contained air, mix with it a piece of friable German yeast the size of a pea, and pour it into a ureometer, or into a test tube, and insert the latter over a mercury bath. If a fermentable sugar is present CO_2 gas will form and appear as a bubble at the top of the tube after a few hours, and the specific gravity of the urine will have fallen. In order to make the test quite certain there should be two control tubes, one containing a glucose solution and a piece of yeast from the same specimen to ensure that the latter is active, and another containing normal urine and yeast, as the latter itself may sometimes give off gas.

The fermentation test is very trustworthy. If positive, we infer that glucose is present, for, although lævulose and maltose are also fermentable, they do not, so far as we know, occur in urine, except in company with glucose. If the fermentation test is negative, the conclusion is either that the copper-reducing agent is not sugar, or that it is the rarely occurring lactose or pentose. The former would only occur in a suckling woman, and, if unaccompanied by glucose, is not of unfavourable import. The presence of pentose may be decided by the orcin test described by Reichel. The urine is heated with an equal quantity of concentrated hydrochloric acid and a few particles of orcin for half a minute (not longer). If pentose is present, a dark green colour appears, due to the formation of furfurol. The presence of sugar may be further confirmed by the phenylhydrazin test. So much for the facts which the foregoing tests establish ; we will next consider their significance.

If the reducing agent is not sugar, the examiner should remember that drugs can produce it, and it is important to know if drugs are being taken, and why. Otherwise its presence need not influence his mind adversely. If the reduction of the copper is due to glucose, it has to be considered, in each case, whether its presence denotes diabetes or not. This question is frequently difficult to answer, for, in life insurance, one seldom meets with acute diabetes, for the reason that such persons have well-marked symptoms, and feel ill, and do not present themselves.[1] The larger number of cases of diabetes arise insidiously, we know not when. At first the glycosuria is transient, appearing, it may be, after physical or mental strain, but unaccompanied by any definite symptoms. Fitness returns and the sugar disappears. This may go on for years, the sugar appearing intermittently whenever health droops, but it will appear more and more readily, and tarry longer. All this time there need be no sign of illness, and whether the sugar is discovered depends on the chance of the urine being examined routine by the medical attendant, or at an insurance office. Then suddenly the sugar becomes constant and large in amount, the classical symptoms appear and death ensues, after a brief space, from coma, the disease being mistakenly dated from the onset of the acute symptoms. Such a sequence of events is so common an occurrence in youth and middle age up to 45 or 50 that if a proposer has, or has had glycosuria, it is necessary for the protection of the office to regard such as diabetes *in posse*, unless the contrary can be established. And it is often very difficult to establish the contrary, for suppose that a proposer, of 35, gives a history of transient glycosuria one year previously ; suppose that his medical attendant had applied the copper test and no other, and after the lapse, say, of a week or ten days a re-examination of the urine showed the "sugar" to have disappeared. In such a case, it may be impossible to ascertain for certain whether the copper reaction was due to sugar, or some other reducing agent, and if due to glycosuria, whether the latter was diabetic or non-diabetic. If the copper test is found to be positive by the medical examiner, he can, and does ascertain if sugar is the cause, but he may be unable to determine whether the cause is innocent. Perchance diabetes is casting its shadow before it. Re-examinations of the urine may clear up the question, but the appearance of the sugar is erratic, and the circumstances of insurance do not permit these examinations being often repeated. The only safe rules, then, with proposers up to 45 to 50, are to treat copper reduction as due to sugar, and glycosuria as diabetic, unless there is evidence to the contrary. In the absence of such evidence, the case must be regarded as diabetes *in posse*, if not *in esse*, and the proposal declined, or, in special circumstances, accepted for a short term at high rates. This rule may seem rigid, when applied to individuals who feel, and present the aspects of, good health, and it is true that, at this stage, treatment will ward off the developed disease for a long or even indefinite period. But life insurance has to view the proposer not as he is, but as he is going to be, and looks to the future rather than the present. Nor can an office control the conditions under which its proposers may live, nor assume that special precautions as to diet will be maintained.

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[1] For this reason the tests for acetone and oxybutyric acid are not often of practical utility in life insurance examinations.

Undoubtedly the guidance given above leads to considerable injustice to individual cases, and an innocent urine may be treated as if it were diabetic. This emphasises the importance of making the examination of a doubtful case searching and critical, for if, through over-caution or indifference, any medical officer rejects such a case on the copper test alone, he prejudices it in the eyes of any company to whom a proposal may subsequently be made, for enquiries are always instituted concerning previous proposals, and the reason for their rejection or loading. Over the age of 50, the significance of glycosuria is different. There is the same difficulty in saying when it is, or is not, potentially diabetes, but the important distinction is this, that the condition may remain in this potential stage for years, and perhaps never proceed further. Although the symptoms of acute diabetes may, and do sometimes develop, this is not the common occurrence; for this glycosuria of later life, even when it must be regarded as diabetic, runs a more chronic course; its subjects are more often fat than thin, it may alternate, or co-exist with albuminuria, and be an expression of gout and arterio-sclerosis. It is not uncommon for such a case to take on, with the lapse of time, the features of chronic Bright's disease.

Although diabetic glycosuria of later life is not, like that of early life, so treacherous as to be outside the pale of insurance, yet it always requires a heavy addition to the premium, and often must be rejected. If the sugar is not large in amount, if it is banished by a moderately strict regulation of the diet (that is, one which permits a small amount of starches), if it has been known to exist for some time, in conjunction with good health and moderate weight, if there is no albuminuria, and the specific gravity of the urine is about normal, and if the arteries are not degenerate, on these conditions the risk can sometimes be entertained at increased rates. These elderly chronic diabetics, although they are less liable to develop wasting and coma, yet run the risks of renal disease, arterio-sclerosis, and cerebral hæmorrhage. They also have a low resisting power, and if invaded by influenzal, staphylococcal, streptococcal, pneumococcal and other infections, their chances of recovery are considerably diminished.

Non-Diabetic Glycosuria.—This is always small in amount and transient. There is a limit to the amount of glucose which the healthy body can store as glycogen at one time. When that limit is exceeded, there is an increase of sugar in the blood, and sugar appears in the urine (alimentary glycosuria). In a normal person, 100 grammes of glucose can be taken at one time without sugar appearing in the urine. If glycosuria does follow, it shows that the storage capacity of the liver and other organs for glycogen is impaired. This diminished storage capacity may have a varied causation, thus we find glycosuria occasionally associated with physical or mental shock, the paroxysms of whooping cough, neurasthenia, meningitis, with certain of the infections, alcoholism, and with Graves' disease. If the glycosuria can be definitely ascribed to some such cause, and, if that underlying condition is cured, and with it the glycosuria, then an insurance proposal may, after an interval, be accepted. But it is just a question whether even these transitory glycosurias do not sometimes denote an increased vulnerability, *i.e.*, a greater liability, to diabetes. Each case may be put to the test. If, when health is established, an intake of 100 grammes of glucose at one time is not followed by glycosuria then all is well ; but, if on the other hand, glycosuria does follow, then the assimilative power for carbohydrates is defective and the life must be loaded.

Pentosuria.—Pentose is a carbohydrate with five atoms of carbon (or multiple of such). Its rare presence in the urine has no clinical significance. Its chief importance lies in the fact that it reduces copper as readily as glucose, and thus the presence of the latter may be wrongly inferred. The employment of the orcin and fermentation tests would prevent error in a doubtful case. The presence of pentose would not prejudice in any way the acceptance of a proposal.

NOTES FROM FOREIGN JOURNALS.

TREATMENT OF DIABETES MELLITUS.

Naunyn, of Strassburg, considers that diabetes can be improved, and that a relative, though not an absolute, cure may be obtained. Prophylaxis must be insisted on in the case of those having any hereditary tendency, especially obese children. In order to secure a good result, an indispensable factor in treatment is to estimate the patient's tolerance for carbohydrates, in other words, to determine the degree of assimilation for sugar in his metabolism. Obviously, the estimate cannot be absolute, as no account can be taken of the sugar derived in metabolism from all albuminous bodies. The superficial and approximate estimate is sufficient for all practical purposes, for the severity of the case can thereby be gauged.

Dietetic treatment is first in importance. The food prescribed must be simple, and all artificial foods must be excluded, in order to keep up the necessarily strict supervision of all food taken. The dietary must be drawn up upon the basis of the value in calories of the separate constituents, and with due regard to the patient's caloric requirements. He must have enough, but not too much. In accordance with modern opinion, Naunyn allows fats to take a prominent place in the diet by virtue of their high value in calories. He insists on the inclusion of fast-days in the treatment. Carlsbad and Neuenahr are of advantage, because of the varied inducements for treatment, the mental repose obtained, and the forcible impression made ; but he attaches very little importance to the direct action of the waters of these places upon the assimilation of sugar in metabolism. The cure of the patient is not obtained by any one form of treatment, or at one time, but is only brought about by continuous control and care on the part of the physician. Severe cases ought to be treated in hospital. Naunyn, after mature consideration, sets his face against all peculiar methods of treatment, such as plum-cure, milk-cure, vegetarian treatment, potato-cure, or oatmeal-cure. —*Deutsch. med. Wochenschr.*

TREATMENT OF DIABETES.

Von Noorden, in his Hertes lecture on this subject, said that dietetic treatment is the best. Prophylaxis is seldom possible, but should be enjoined, when several cases occur in one family. Transitory glycosuria must be looked upon as a danger signal, and carbohydrate food reduced to a minimum, in order to conserve the patient's tolerance. As the true ætiology of diabetes is still unknown, ætiological treatment is not possible. There is no such thing as neurogenous diabetes, but there is a neurogenous glycosuria, which plays a large part in the production of true diabetes. Nervous influences lead in many diabetic patients to an increase of the diabetes. In severe cases, the connection is obscured, but is clear in mild cases. Mental excitement may cause glycosuria in a patient, who, under proper diet, is free from it. Too much attention must not be paid to these nervous factors to the neglect of food precautions, but they may require treatment by potassium iodide, codeia, or even in a sanatorium. Glycosuria may be produced by syphilitic affections of the nervous system (syphilitic meningitis), or of the pancreas, chronic induration and parenchymatous pancreatitis. Hence mercury may improve some cases, but very few have been recorded. Organo-therapy has been tried with the view of promoting glycolysis. The pancreas preparations have been tested by v. Noorden, who finds them of no effect upon diabetes, but they improve the digestion of fats. Thyroid and suprarenal extracts of themselves produce glycosuria. v. Noorden thinks possibilities lie in this direction, but the extracts must be of organs which increase the metabolism of sugar in the body.

Treatment by drugs has been and continues to be most extensive, but only very few are of use. Of these, opium stands first, though it has been much misused. It should not be given to patients passing large quantities of sugar. It is most useful in cases in whom dieting has brought the sugar down to about 300 grains a day, as, in such, the total disappearance of the sugar will be obtained by giving 2 to 2½ grains of codeia a day. Diabetic patients bear opium well. Next to opium is salicylic acid, which is useful in those cases in which opium fails. The best form, in which to give this drug, is acetyl-salicylic acid (patented in Germany as "aspirin"). It improves carbohydrate assimilation. Salicylic acid must not be given if there is any renal complication or gastro-intestinal irritability. Jambul seeds counteract the effects of phloridzin-diabetes, but their effect upon true diabetes is doubtful.

Too much reliance has been placed upon treatment in health resorts, the advantages claimed for which v. Noorden characterises as "mostly humbug." Patients return from Carlsbad with an improved tolerance for carbohydrates, because, during their "cure," they have been freed from the worries of daily life, they have had plenty of out-door exercise, if only by long walks, which lessen glycosuria, their diet has been carefully regulated ; the medical men at Carlsbad are well experienced in the treatment of diabetes, and the baths and drinking of the waters have a good effect upon digestive disturbances, obesity, gout, and the like. In the treatment of diabetes, there are two essentials, which do not apply to the same extent in any other conditions or diseases—general regulation of the mode of life and regulation of diet.

TREATMENT OF COMPLICATIONS AND SEQUELÆ OF DIABETES.

Croftan believes that most of the complications of diabetes disappear with a reduction of the glycosuria, and an improvement of the general condition of the patient. Stomatitis, gingivitis, pyorrhœa, loosening and caries of the teeth may be due either to localised infections, or to trophoneurotic influences. These affections of the mouth are some of the most distressing symptoms in diabetes, and it is important that every case, from the first, should pay special attention to a proper toilet of the mouth and gums, so as to ensure, so far as possible, asepsis of the mouth. The mouth and teeth should be cleansed, after each meal, with a 3 per cent. solution of carbonate of soda in warm water, flavoured with eucalyptus or menthol. Hot beverages, and hard or sharp substances likely to scratch the gums, must be avoided, and the use of a hard tooth-brush forbidden.

Fœtor of the breath may be corrected by using :—

℞.	Naphthol β.	gr. v.
	Sodii Biborat.	ʒvj.
	Aq. Menth. Pip.	℥vj.
	Aq. destill.	Oj.

Misce.

If the gums are painful and bleeding, the following is useful :—

℞.	Tinct. Opii	ʒvj.
	Potass. Chlorat.	
	Sod. Bibor.	āā ʒiiss.
	Decoct. Altheæ rad.	Oj.

Misce.

The care of the skin is also of importance, in view of the tendency to boils, acne, erysipelas, eczema, and gangrene. Lukewarm baths, containing soda or salt, are very useful, and, after such an one, the skin should be carefully dried with soft, warm towels, and treated with cacao-butter or oil. Severe rubbing must always be avoided. Under-garments should be changed frequently, and the cleanliness of the skin promoted in every possible way.

Pruritus is either general or local, and is often obstinate ; the former appears to depend on irritation of the cutaneous nerves by sugar circulating in the blood, and its intensity varies with the degree of glycosuria, disappearing when the urine is sugar-free, and reappearing when hyperglycæmia increases. The best remedy is salicylate of soda internally, in doses of 30 grains, several times a day ; local applications are of very little use.

Pruritus of the genital region is sometimes due to fungous growth (*Mycosis vulvæ*), and usually to leptothrix. Reduction of sugar in the urine, salicylate of soda internally, and soothing powders or ointments locally, relieve this most distressing symptom. A 5 per cent. cocaine ointment, or one containing 3 per cent. of orthoform, with frequent washing, gives quick relief.

Dyspepsia always requires attention in diabetes, because the patients depend so greatly on the proper working of their alimentary system, and, moreover, dyspeptic symptoms are the usual foreboding of the development of coma. They are very commonly due to monotony in the diet, as, for instance, excessive amount of meat-fat, polyphagia, or overmuch water drinking. In severe cases of gastric irritation, it is best to withhold food for 24 hours, giving merely a little broth, milk, and water, or a little claret and water by the mouth, and feeding the patient by the rectum. To allay vomiting and gastric pains, cerium oxalate in 10 grain doses frequently repeated, or cocaine, or 2 per cent. chloroform-water should be given, at the same time applying hot or cold compresses to the epigastrium.

The severe thirst, engendered by the deprivation of taking food and drink by the mouth, may be allayed by sucking small pieces of ice, chewing gum, or smoking. The patient should return to his full diet by degrees.—*Clinical Review and Therapeutic Gazette.*

TREATMENT OF DIABETES.

The *Gazette médicale de Paris* contains a summary of Professor Dieulafoy's treatment. He is opposed to the total prohibition of bread, potatoes, and other carbohydrates, because the patient thereby loses flesh, and is, in consequence, more liable to be attacked by tubercle. He quotes a patient, who passed 80 grains of sugar a day, and became sugar-free when placed on strict diet, but, at the same time, lost appetite, strength, and 6 kilos. in weight, whereupon he demanded the restoration of his sugar to make him better. Treatment must include hygiene and drugs, as well as diet. The diet should include eggs, fish, grilled or roast meat, green vegetables, potatoes, or peas occasionally, crust of bread well baked, beer, and milk. Wine, not sweet, is allowed mixed with an alkaline water, the best of which for continuous use in Eau de Pougues (Saint Léger). Hygiene comprises attention to the skin by baths, rubbing, douches, massage, and exercise by walking or gymnastics, avoiding profuse sweating and fatigue.

He uses three drugs for treatment—antipyrin, arsenic, and alkalies, giving them in the following way:—For one week the patient takes at each meal a cachet containing 4½ grains of antipyrin and 3 grains of bicarbonate of soda. The following week these cachets are replaced by draughts, at each meal, containing ½ to ⅔rds of a grain of arseniate of soda in 2½ ounces of distilled water. This weekly alternation is kept up for some months. Throughout the patient takes alkaline waters, pure or mixed with wine, for Dieulafoy thoroughly endorses Trousseau's opinion as to the value of alkalies in the treatment of diabetes.

THE EFFECT OF THE DRUGS RECOMMENDED FOR THE TREATMENT OF DIABETES.

Kurt Fleischer, in the *Therapeutische Monatshefte*, reviews the effects produced by some of the chief anti-diabetic remedies. It is recognised, generally, that diet by itself is not sufficient, but requires assistance. No drug is as yet known to be a specific. Kaufmann postulates five necessities for an anti-glycosuric remedy:—

1. It must be harmless.
2. When in constant use it must reduce glycosuria, whether the food is carbohydrate-free or not, and must not produce any toxic effect.
3. It must bring about sugar-free urine more quickly when a strict anti-diabetic diet is being taken.
4. It must increase the patient's tolerance for carbohydrates.
5. Its effect must last for some time after administration has ceased.

The various remedies may be classified into groups.

I. *Sedatives.*—These are given on the theory that the condition must have some connection with the nervous system. First among these is *opium*, which was recommended by Dobson in 1774, and has been used since then in greatly differing doses. Von Noorden questions the value of large doses (6 grains and upwards of Ext. Opii a day) owing to the risk of toxic symptoms, whilst Naunyn has obtained good results from a daily dose of 4½ grains. Von Mering gives opium for three weeks at most, three times a day, increasing the daily amount up to 7½ grains, and then decreasing.

Bohland, on the strength of his case mentioned below, advocates a long-continued administration of large doses of Tinct. Opii. Von Mering, as well as the last mentioned, lays stress on the fact that opium acts better in those cases, in which the sugar arises from albumin, than in those in which it is derived from carbohydrates. It is therefore more useful in cases in which sugar persists in the urine, when the patient is taking a carbohydrate-free diet. Strasser points out that opium spares to the patient his necessary proteid by preventing the formation of inosit. Both von Noorden and Naunyn support this view, and consider that opium renders good service in nervous diabetes because it is a sedative. Bohland published a case of cure by large doses of Tinct. Opii. The patient, who was losing 5 to 6 per cent. of sugar, and passing 8 to 10 litres of urine, also suffered from sciatica, which he was treating, unknown to his medical man, with Tinct. Opii. He kept this up for a year, and was eventually taking 5 to 6 drachms of Tinct. Opii a day. This amount produced symptoms of poisoning, and the use of the drug was stopped, but the urine remained quite free from sugar for more than three years.

Strauss, von Mering, and Naunyn, after sundry experiences, recommend large doses, but Kaufmann doubts if there is any specific action. Opium derivatives are less effective than the drug itself.

Bromide of potash has been recommended by von Noorden, who has lately been using bromipin with good effect, in addition to which it has the advantage of introducing 30 to 40 g. of fat a day into the system.

II. *Anti-ferments.*—These were given on the idea that sugar-formation and assimilation are the effects of ferments, and consequently either anti-ferments (anti-diastases) or ferment-producers (glycolytic) are required.

Meyer, of New York, praised *corrosive sublimate*, which he gave in doses of $\frac{1}{6}$th of a grain three times a day, believing that glycosuria is the result of bacterial and toxin action upon the store of glycogen, or upon the nerve centres. Von Noorden and Kaufmann condemn the drug, as its small and transitory anti-glycosuric effect is far from proportionate to its extreme toxicity.

Salicylate of soda was first used in the treatment of diabetes by Ebstein, in 1887. Senator, Fürbringer, and others recommend a dose of 75 to 150 grains. Litten gave one tablespoonful of a 4 per cent. solution every two or three hours, and, after an experience of its use in 141 cases, came to the conclusion that it is very useful for the relief of polydipsia and pruritis, but is not a satisfactory anti-diabetic agent. Of late years, the drug has been replaced by *acetyl-salicylic acid* ("aspirin," so-called), which von Noorden finds is better borne than salicylate. Given in a daily amount of 15 to 45 grains, it increases the tolerance for carbohydrates by 30 to 60 g. Strauss confirms this, and points out that, during administration, the weight increases, and that the decreased sugar secretion is not due to impaired digestion. Kaufmann finds it useful in slight, but of no use in severe cases. *Salol* was tried by Sahli, in 1886, with the idea of combining the good effects of phenol and salicylic acid. 1 to 1½ drachms may be taken daily without digestive disturbance. Taschemacher, of Neuenahr, after four weeks' course of the waters, obtained a reduction in the amount of sugar. The patient was then given 1 drachm of salol a day for five days, and the sugar was brought down to a trace. Zandy, by dieting, reduced the sugar to 36 to 46 g. per diem. Four days' treatment with 1 drachm of salol a day resulted in sugar-free urine.

Antipyrin has been greatly praised in France, but has not been used very much in Germany. Robin speaks very warmly in its favour.

Piperazin was recommended by Hildebrandt, on the strength of his experiments, which showed that it possessed an anti-fermentative action, and, at the same time, increased the alkalinity of the blood. These experiments were very successful in dogs suffering from phloridzin-diabetes. Bohland's results, however, were negative in dogs and man.

Quinine and arsenic are much in favour with Robin, but have not much vogue in Germany. 30 grains of quinine and 30 drops of Fowler's solution are given daily.

Iodine has been quite laid aside of late years, although Seegen reports that aglycosuria resulted from giving 20 to 30 drops of Tinct. Iodi. Moleschott, in 1882, gave *iodoform*, 1 grain a day, and obtained a good result.

In Germany, the last-mentioned drugs are looked upon as of historical interest only in this connection.

III. *Ferments.*—These are given to increase the intensity of the pathologically reduced sugar-assimilating ferment, and thus to prevent excretion.

Diastase was recommended for further trial by Kussmaul in 1874. He injected 1½ to 3 grains dissolved in 20 minims of water into the subcutaneous tissue. Lépine, in 1895, tried giving it by the mouth, using a solution of 5 g. of pure malt diastase in a litre of water acidulated with 1 g. of sulphuric acid. The mixture was warmed to 95°—100° F. and neutralised. The treatment is very costly, and its effect soon passes off. It has not yet been used intravenously. Senator sought to obtain the same good effect by using *brewer's yeast*, 50 g. a day gave a good result. Further trials needed.

IV. *Organic Extracts.*—The selection of these, obviously, fell to those from the liver and pancreas. Gilbert and Carnot tried *liver extract* in 1896; three of their cases had a transient reduction, five a permanent, and four a doubtful decrease in sugar excretion. Much more has been done with *pancreas extract*. Comby tried hypodermic injections of pancreas-juice. Since then it has been given as gland-substance *per os*, and as solid extract, in tablets, as well as *per anum*. In one case, a living pancreas has been transplanted. The results in Germany have been negative, but, in view of the close connection shown by Minkowski to exist between diabetes and pancreas changes, further work on this point must be done.

V. *Inorganic Preparations.*—First among these are the *alkalies*. Senator's researches on these led to no result, and he attributes the good effects obtained at Vichy and Neuenahr, to the change in living, to the regulated diet, and, above all, to the "procul negotiis" of the patient. Warm water itself has a preventive effect upon sugar-excretion, as Glax has shown. Von Mering confirms Senator's views, and finds the waters are of no effect, in cases which respond to opium. The "cure" at Carlsbad, Vichy, and Neuenahr is good for cases complicated with obesity. Strasser, however, thinks the alkaline sulphate waters of Marienbad and Carlsbad, as well as the plain alkaline water of Neuenahr, decrease sugar and thirst, while increasing tolerance. Lenné considers that no means, not even opium, are so effective, as the waters of these health resorts, in reducing sugar and thirst, and improving appetite, mental condition, and general well-being. Barth sets a high value on pure alkali given as bicarbonate of soda in slight or gouty cases.

Lime was first recommended by Grube, one of whose patients had, on lay advice, eaten eggshells as a cure, with good result. This was attributed to the presence of carbonate and phosphate of lime. Grube made further trial with satisfactory result. Von Noorden has pointed out that, in diabetes, an increased output of lime is due to a diminished intake of lime in the contents of the meat diet, which is poor in lime salts. Lenné, on these grounds, ordered one teaspoonful three times a day of 10 per cent. phosphate of lime and 90 per cent. carbonate of lime, but with no result.

Ammonia was tried by Guttmann, giving the chloride and citrate alternately, but with poor results. Adamkiewiez and Eichhorst each made a trial with better results.

Uranium salts were said by Duncan and West to possess anti-glycosuric action, but they have not been tried out of England.

VI. *Vegetable Preparations.*—Many have been tried and found wanting. Linseed tea, bean-shell tea, and whortleberry tea are mentioned. In 1902, von Noorden brought forward the subject of an *oatmeal* cure in severe diabetes. He gave 200 g. of meal a day, cutting off all other carbohydrates. After 14 days, the utmost a patient can stand, he found considerably less sugar and less acetonuria. In a recent publication, the régime is now composed of—

250 g. of oatmeal. (Knorr's oatmeal or Hohenlohe's oat-flakes.)
150 g. of vegetable albumen (roborat).
300 g. of butter.

With this he has obtained some notable results in very advanced cases of coma, but he expressly warns against the idea that it is suitable for all cases.

Jambul seeds, from a West Indian plant, the Syzygium jambolanum, was introduced, in 1889, by Graeser, after experiments in phloridzin-diabetes in dogs; but as this is not the same thing as human diabetes, successful results have not followed to any great extent. Binz, von Mering, and especially Bohland, have worked at the subject, while Hildebrandt has carried out some interesting experiments on the action of these seeds. He finds that the extract limits the formation of sugar in the alimentary canal, and of glycogen in the tissues. Its effects vary in each case. Gerlach found it useless, Lewaschen obtained uniform results in 8 cases, using 20 to 40 g. of the freshly prepared powder. Kaufmann's results were not altogether satisfactory, using the fluid extract, which von Noorden considers the best form, when well diluted with hot water, to avoid alimentary disturbances. It appears to be suitable as an aid to dieting.

VII. *Modern Special Remedies.*—This group comprises preparations supposed to be specifically anti-glycosuric, but as to which, von Noorden remarks, "everyone, who employs one of these preparations with the expectation of being able to benefit his patient, hands to the victim a cleverly planned humbug."

Antimellin is identical with djoëatin and jambulin, and was praised by Börsch as a wonderful specific. As it contains, among other things, salicylic acid, jambul, and opium, it is not surprising that favourable results are sometimes obtained, but it is not a specific in the sense of being independent of dieting.

Saccharosolvol is a preparation made in Leipzig, and contains salicylic acid. *Glycosolvol* comes from Dresden, consists of a powder, jambul seeds and aromatics, recommended to be taken in the form of tea night and morning, and of a tincture of glycosolvol, in fluid extract of myrtle leaves, which is taken at mid-day. It is stated to be "peptonised oxy-propionate of theobromin-trypsin"! Traces of theobromin were found on analysis by Eichengrün with 60 to 70 per cent. of starch! Recently, from Berlin, has appeared a "safe cure for diabetes" called *Senval*. This also consists of a fluid extract, and a powder, the former contains senecio, valerian, cina, castoreum, and peppermint, while the powder is a mixture of bicarbonate of soda, chlorate of soda, sea-sponge, phosphate of lime, and iodate of lithium.

Fleischer sums up his paper by saying that no specific remedy is known at present, that opium has a relatively sure effect, and that salycilic acid and jambul seeds are not equal to opium.

ACTION OF ALCOHOL UPON THE ELIMINATION OF ACETONE.

Otto Neubauer writes on this subject, in the *Münch. med. Woch.*, pointing out that the prophylaxis and treatment of this grave complication of diabetes are urgently necessary, in view of the ætiological importance proved by many experiments to attach to the appearance in the urine of acetone-bodies (acetone, diacetic acid, oxybutyric acid). The treatment by large quantities of alkalines for the purpose of neutralising the acids, and of promoting their elimination by the kidneys, is based upon the theory that these bodies act chiefly by means of an acid intoxication, but as in practice the results of this treatment have not been very encouraging, the question is raised as to better results being obtained by preventing, at the outset, the production of these toxic bodies.

The exclusion of fats from the diet has been recommended, as these favour the change of the fatty acids into acetones. But such an exclusion means reducing the patient to a state of inanition. Another suggestion is to increase the ordinary carbohydrates, but this will increase the hyperglycæmia. The difficulty is solved, if some substance can be found, which will be as effective as carbohydrates in checking the production of acetones, but which does not, at the same time, increase the already existing amount of glycosuria. Xylose, mannite, glycerine, and glyconic acid have been tried, the last with some success, but none of them are suitable for continued use, being either of an ill-flavour, or having a purgative effect, or being very costly.

Neubauer has tried if alcohol will not answer the required purpose, by giving daily an amount of wine equal to 2½ to 5 ounces of alcohol to patients passing a large amount of acetones, consequent on the suppression of carbohydrates. He found, in four such cases, that there was a considerable decrease in the elimination of acetone, oxybutyric acid, and ammonia, while, at the same time, there was less sugar in the urine. When the alcohol was stopped, the elimination of acetones increased again. The effect is not so marked in patients passing but a small quantity of acetone.

His results enable him to recommend wine in moderate amount for cases with grave acidosis, if no special contraindication exists.

POTATOES IN DIABETES.

Sternberg, in the *Deutsche med. Woch.*, recommends a way of ridding potatoes of the greater part of their starch. Raw potatoes are scraped into water. After a time, this farina settles to the bottom of the receptacle. The water is poured off and the wet farina is placed in a linen bag, and the water expelled by pressure and subsequent drying. From this residue many appetising dishes may be prepared.

DIABETESERIN.

Fraenkel, of Berlin, published a paper in the *Medizinische Klinik*, at the end of 1905, on the treatment of diabetes, in which he suggests that arteriosclerotic changes are mostly the cause of diabetes. He believes that the transmission of the tendency to diabetes depends upon the transmission of anomalies of the circulation having a nervous origin, and these anomalies are equally concerned in gout, obesity, and obstinate constipation.

The first stage in the production of diabetes is represented by arteriosclerosis, and the consequent stagnation in the circulation of the blood through the parts affected, that is, those supplied by the great splanchnics and branches. He has, therefore, devised a treatment, which combines an attack upon the early symptoms of sclerosis by means of Trunecek's serum, and relieves the stagnation of blood, sending it freely through the liver, by means of the action of eserine upon the vagus, and thereby upon the vasomotors. He uses tablets composed of the salts of Trunecek's serum, and, out of 29 cases, obtained good results in 22, little effect in 5, and no improvement in 2. The dose of eserine is ·0005—·0008 g., = $\frac{1}{120}$th to $\frac{1}{75}$th of a grain.

The salts of Trunecek's serum, contained in each tablet, are:—sodium chloride, ·8 g. (= 12 grs.); sodium sulphate, ·08 g. (= 1$\frac{1}{4}$ grs.); magnesium phosphate, 0·3 g. (= $\frac{1}{2}$ gr.); sodium carbonate, ·03 g. (= $\frac{1}{2}$ gr.); sodium phosphate, ·025 g. (= $\frac{3}{8}$ gr.); and calcium glycerophosphate, ·025 g. (= $\frac{3}{8}$ gr.). For the relief of obstinate constipation, another tablet is used containing eserine and atropine, ·0003 g. (= $\frac{1}{200}$th gr.). Diabeteserin can be obtained in the United Kingdom from Messrs. Reitmeyer & Co.

Confirmatory results have been published by Markbreiter (*Wiener med. Presse*, No. 36, 1906) giving details of 4 out of 10 cases treated; by Assman (*Medico-Medizin. Wochenrund.*, No. 22, 1906), giving details of 2 cases; by Huber (*Zentralbl. f. gesamte Therapie*, No. 9, 1906), 4 cases; and by Friedmann (*Oesterreich. Aertzezeit.*, No. 12, 1906), giving details of 3 cases out of 10 treated.

The diet directions are similar to those usually ordered nowadays, but carbohydrates are sparingly allowed.

SANTONIN IN DIABETES.

A paper, in *La Quinzaine Thérapeutique*, of 10th March, 1907, summarises recent researches into the action of santonine, which has been found by French and Italian observers to be of good service in the treatment of the lightning pains of tabes. In addition to its analgesic effect in these symptoms, the drug is found to have a restraining influence upon the nervous system, quite as marked and as definite as its anti-spasmodic action.

Following up this line of thought, Séjournet, of Bourges, was led to try the effect of santonine in the treatment of diabetes, and he found that, under its influence, the sugar was reduced, the polyuria decreased, the patient's strength improved, thirst diminished, and the mouth became less dry.

An average dose of santonine is given two or three times a day, according to the severity of the case, and should be taken at meals. This is kept up for about 14 days, the patient, at the same time, taking plenty of alkaline ; 30 grs. of carbonate or benzoate of lithia are recommended twice a day. This alkaline treatment is continuous throughout, but the fortnightly courses of santonine are separated by an interval of from 20 to 30 days, and it is alleged that it is rarely necessary to have more than three of these santonine periods. It is claimed that no special diet is necessary, but that strict attention should be paid to hygiene, and, when possible, a cure should be completed by a course at Saint Christian, la Bourboule, or Mont-Dore, whose waters are arsenical.

USE OF SUGAR IN DIABETES.

Oefele of Bad Neuenahr recommends an allowance of ordinary cube sugar in diabetes. He claims for his startling suggestion that patients feel very much better for it, that it does not increase the amount of sugar in the urine, and that it can replace albumins. He insists, however, that no sugar must be given without immediately subsequent muscular exertion, and also that in diabetic patients no great muscular exertion should be undertaken without a previous administration of sugar. It may be given in water, coffee, etc.

Orlowski, at the request of von Noorden, undertook further investigations into the value of enemata of sugar in diabetes, as recommended by Arnheim, who has published results showing that sugar, when given *per rectum*, is assimilated and acetone-bodies disappear from the urine. Orlowski found that the increase in sugar excretion, after administering a sugar enema, is notably less than when it is taken by the mouth, and that, in severe cases, it causes no increase subsequently. He also found that the sugar is actively absorbed, and not merely left in the bowel. It is, however, only suitable for occasional use.

FORMALDEHYDE TEST FOR ACETONE.

Prof. Strzyzowski, of the Laboratory of Physiological Chemistry in Lausanne, has been making further investigations into the abnormal production of metabolism, which, in diabetic urine, gives a green fluorescence on the addition of some 5 per cent. solution of formaldehyde, after standing for some time. It is only met with in severe cases, and is of evil import to the patient, for it betokens the imminent onset of coma. It disappears immediately before death.

There is a certain parallelism with Gerhardt's test with perchloride of iron. No definite results have as yet been obtained with respect to the composition of the body concerned.

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Notes by the Way.

THE PRACTITIONER.

THE PRACTITIONER has now entered on the fortieth year of its existence, and we think that we are justified in saying that it continues to fulfil the useful purpose which its founders had in mind, and which has been steadily kept in view by those who successively have had the conduct of it since. As its title imports, it was intended to be, above everything, practical in scope and in character, and to supply the general practitioner with such help as he needs in keeping himself abreast of progress in the clinical knowledge of disease and in therapeutics, using the word in its broadest sense. "Art," says the Father of Medicine, "is long"; the truth of this aphorism is likely to be borne in upon anyone who should try to absorb the miscellaneous medical lore contained in the encyclopædias of which the groaning press is delivered weekly. On the other hand, no one feels more keenly that life is short than the busy doctor. It is for him that THE PRACTITIONER is designed.

Our endeavour is to give just the kind and amount of mental aliment that he can take without surfeit or weariness. That our efforts are not unsuccessful is shown by a rapidly increasing list of subscribers, and by the numerous letters of appreciation which we receive. Such unsolicited testimonials from subscribers to journals are not too common; they are, therefore, all the more welcome. Our readers may be assured that nothing shall be wanting on our part to make THE PRACTITIONER increasingly worthy of their approval.

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Our Special Number.

THE present issue of THE PRACTITIONER is one of the special numbers for which, we may be allowed to say, the journal has acquired a reputation, not only at home, but abroad. We have received many testimonies from practitioners of their appreciation of the value to the busy man of these numbers, in which the teaching and experience of recognised authorities on a particular subject are concentrated in a number which thereby possesses the character of a monograph on the subject to which it is devoted. Moreover, it is a monograph of extraordinary value, owing to the fact that, being written by many men, each of whom treats of the aspect to which he has devoted special attention, it reflects the exact state of contemporary knowledge and opinion. We venture to think that our readers will find this special number, which deals with a condition of the greatest practical importance, and one as to which clinical observation and experimental research have lately opened up new views in several directions, of more than ordinary interest and value.

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The Natural History of Diabetes.

PROFESSOR HALLIBURTON speaks with the authority of a leading physiologist on what may be termed the natural history of diabetes. One fact of particular interest which he mentions is that adrenalin, which has shown itself a useful remedy in several directions, has itself the property of producing glycosuria.

Dr. A. P. Beddard's article on the Urine in Diabetes should be read, marked, and inwardly digested by every practitioner. A valuable warning to doctors, as well as to patients, is contained in the statement that a mild may be transformed into a severe type of disease by a "carbohydrate debauch," by anæsthetics, by intercurrent disease, or by mental strain. In his paper on Gouty Glycosuria Dr. Alfred W. Sikes also gives a useful warning when he says that it is usually better, in mild cases, not to tell the patient that he is passing sugar. To call simple glycosuria "diabetes" is not only to make an erroneous diagnosis, but often has a very bad effect. "We have all," he says, "met gouty patients who had been told years before that they had 'diabetes,' and who, when we examined them, had not a trace of sugar in the urine."

Sir Lauder Brunton, writing on the heart in relation to diabetes out of the fulness of a very large experience, says that, in gouty glycosurics, while the excessive sugar in the blood is injurious to the nutrition of the heart, the risk which is chiefly to be feared is from alterations in the peripheral vessels leading to high tension, and cardiac hypertrophy with subsequent failure, or to rupture of a vessel and apoplexy.

Dr. J. J. Perkins contributes a valuable paper on the pulmonary complications of the disease, which summarises existing knowledge on the subject.

In regard to diabetes in children, Dr. Morley Fletcher notes the interesting fact that there does not seem to be the same liability to the disease in Hebrew children that is observed in adults of the same race.

Although it is a matter of common knowledge that mental depression is often associated with diabetes, Dr. James Taylor's description of the other nervous symptoms, especially neuralgia and neuritis that are frequent accompaniments of the condition, will doubtless be instructive to many who have not had such large opportunities of observation.

Dr. Hyslop, of Bethlem Royal Hospital, gives a clear account of the various relations of diabetes to Insanity.

Dr. Rose Bradford's short but extremely valuable communication on the Pancreas in Diabetes is of especial interest, from the fact that, as he says, the relationship between diabetes and pancreatic disease is one of the many subjects in medicine in which experimental research has been the means of clearing up difficulties in the interpretation of symptoms.

Mr. Walter Jessop writes on the ocular complications in diabetes. Of these, as is well known, cataract is the most common, and he makes the interesting remark that there are several cases on record, in which marked cortical striæ have disappeared in diabetes, under treatment for the glycosuria. It is interesting, as he says, to note that these diabetic cases are the only ones known, in which general treatment has effected a cure, or great improvement, in the condition of a cataractous lens.

Mr. Malcolm Morris reviews the skin diseases which frequently occur in diabetes. As he points out, though these affections have no special character that marks them as diabetic in origin, they have often a peculiar persistence and tendency to recurrence.

These papers taken together give a full account of the nature and symptomatology of diabetes.

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The Treatment of Diabetes.

THE treatment of diabetes is discussed by several writers of acknowledged authority. The subject is very fully dealt with by Dr. Alfred R. Parsons, of Dublin, whose paper is a summary of all that is at present known on the subject. If it reflects the great divergence of opinion on the subject, which exists among men of experience, it can scarcely fail to furnish the practitioner, who has a difficult case to deal with, with some useful hints. Dr. Parsons's principal conclusions are that there is no specific treatment for diabetes, that drugs at best play but a subsidiary part; that opium is the best drug in severe cases in which a rigid diet fails to remove all sugar from the urine; that sodium salicylate and aspirin are valuable in mild cases; and that the intravenous injection of carbonate of soda affords the best chance of restoring consciousness in coma.

Dr. R. T. Williamson deals with the drug treatment of diabetes. It will be noticed that he attaches considerable importance to salicylates and aspirin, as well as to codeia. These drugs naturally give the best results in mild forms or cases of medium severity. Dr. Williamson does not seem to attach so much importance to alkaline treatment as many practitioners on the Continent do, but he agrees that it is often useful in warding off, or checking, diabetic coma.

Dr. Walker Hall cites the classification of the degrees of glycosuria from von Noorden and Naunyn, which affords a good basis for treatment. He says that potato and oatmeal starches produce less glycosuria than the starch contained in bread; that albuminates generally increase the glycosuria in slight as well as in severe cases; and that alcohol, in medicinal doses, very frequently diminishes the glycosuria; on the other hand, when taken in excess, a marked increase results. Free "sweating" lowers the sugar output; walking exercise and muscular effort are therefore useful. For the same reason, doubtless, hot baths and high frequency currents are also followed by a lessened sugar output. It is interesting to learn that "secretin" has been found to act favourably in a few acute cases.

The Carlsbad treatment is described in detail by Dr. Fred Kraus. This article embodies the results of an experience which is probably unique, whilst, at the same time, it gives an interesting account of how a health resort is managed abroad, when intelligence is combined with enterprise. It is this that makes foreign health resorts, which, in many cases, have no greater natural advantages than many places in our own country, immeasurably more attractive to visitors than those of Great Britain. One difference is that abroad the management is based upon, and conducted throughout in obedience to, medical advice.

Dr. Marcel Labbé also deals with diet in diabetes. His system of diet may profitably be compared with that of Dr. Kraus.

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Diabetic Gangrene.

Discussing the surgical treatment of diabetes, Mr. Cuthbert Wallace deals mainly with diabetic gangrene. He formulates the important conclusion that the presence of sugar in the urine may, in certain cases, be an indication for operation instead of the opposite. He points out that the diminution or disappearance of the sugar after the removal of the limb, and the septic absorption produced by it, is a remarkable feature in a certain number of cases, and that this suggests that the glycosuria may itself depend upon, or be aggravated by, the septic lesion. "By ablation of a limb," says Mr. Wallace, "we may not only rid the patient of a painful and distressing local condition, but may actually produce an improvement in nutrition, as shown by the diminution, or disappearance, of the sugar from his urine."

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Diabetes and Life Insurance.

Dr. Bertrand Dawson discusses the very important subject of diabetes and life insurance. He critically reviews the various available tests for sugar in the urine, concluding that the only safe rule with proposers up to the age of 45 to 50 is to treat copper reduction as due to sugar, and glycosuria as diabetic, unless there is evidence to the contrary. In the absence of such evidence, the case must be regarded as diabetes *in posse*, if not *in esse*, and the proposal must be declined, or, in special circumstances, accepted for a short time.

It is particularly interesting to note that Dr. Dawson lays stress on the importance of making the examination of a doubtful case very thorough, for, as he says, if, through over-caution or indifference, a medical officer rejects such a case on the copper test alone, he prejudices the "life" in the eyes of any company to which a proposal may be subsequently made. Over the age of 50, the significance of glycosuria is different. What Dr. Dawson calls the "potential" stage may last for years, and may possibly never proceed further. Although the symptoms of acute diabetes may, and do sometimes develop, this is not the common occurrence.

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The Modern Doctrine as to Diabetes.

As already said, the papers in this number as a whole give a view of the modern doctrine as to diabetes. This is, as might be expected, much wider than the older teaching. Those who went through the schools 30 years ago have witnessed a change of opinion on the subject which amounts to a revolution. It used to be taught that the detection of sugar in urine, which was often accidental, was virtually equivalent to a sentence of death within two or three years. The belief inculcated in the lecture-room received rude shocks, when, in practice, patients were met with who had passed sugar for 20 or 30 years without seeming a penny the worse for it. Often, indeed, they saw the doctor, who had pronounced their doom, pass into the silent land long before them.

By-and-by came the dawn of a new day, which brought suspicion to the more enlightened minds of the profession that as Italy in Napoleon's day was nothing more than a "geographical expression," so glycosuria was a "pathological expression" which signified not a definite disease but a symptom of many conditions, varying from formidable organic changes in the brain or pancreas to transient inadequacy of the liver. The history of diabetes is an illustration—one among many—of the proneness of the medical profession to mistake words for things.

With the discovery of the radical difference it was found in the first place that the symptom is relatively common, especially among two classes of mankind: Orientals, among whom we here include Jews, who have by nature a particular liking for sweet foods and drinks; and persons, whose nervous system is exposed to much wear and tear, as financial speculators and brain workers whose intellectual output has to be supplied under conditions of severe and constant strain.

With the growth of knowledge as to the nature of the condition has come a considerable relaxation of the rules of diet which used to be deemed necessary.

The late Dr. Wurtz, of Paris, one day took it into his head to examine the urine of a number of his colleagues of the Académie de Médecine, and found sugar in 5 per cent. of them, none of whom had the least suspicion that there was anything wrong.

The general experience of practitioners is now that too strict a diet is not desirable, except in very severe cases, and in these only for limited periods at a time. Diet, like opium, may control the symptom glycosuria, but it does not remove the condition, and it may help to kill the patient by impairing the general nutrition, and by bringing on diabetic coma. The whole question is at present unsettled. No more striking proof of this can be cited than the fact that, while potatoes are absolutely forbidden by some, there are others who actually make diabetics eat these vegetables as a part of the treatment.

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Practical Notes.

THE TESTS FOR SUGAR IN THE URINE.—Normal urine contains no sugar, but as soon as the amount of sugar in the blood plasma rises above ·2 per cent., the renal epithelial cells excrete it in the urine. In diabetes mellitus, the sugar, which appears in the urine, is dextrose, which is a strongly reducing sugar. It should be remembered, however, that the urine of nursing mothers may contain a little lactose, which is a disaccharide, having the formula $C_{12}H_{22}O_{11}$. This has a slightly sweet taste, is dextro-rotatory, but is a less powerful reducing sugar than dextrose. If it required seven parts of a solution of dextrose to reduce a certain quantity of Fehling's solution, it would require ten parts of a solution of lactose of the same strength to reduce a similar quantity.

The readiest test for dextrose in the urine is with Fehling's solution. This consists of a solution of copper sulphate, to which is added sodium hydrate, which causes a precipitate of cupric hydrate, but Rochelle salt (the double tartrate of soda and potash) is added, which keeps the cupric hydrate, which has been formed, in solution. It is important that the Fehling's solution should always be freshly prepared before using, otherwise, on boiling even with a normal urine, a red precipitate may be thrown down. This is due to the fact that Fehling's solution, on standing for some length of time, decomposes, an isomeride is formed from the tartaric acid, which is, itself, capable of reducing the cupric hydrate to cuprous oxide. A good rule to follow, therefore, is *always* to boil the Fehling's solution before adding the urine to be tested, in order to test whether it is in a sound condition.

The picric acid test, introduced by the late Sir George Johnson, is an extremely valuable one, because it may be used to detect albumin as well as sugar.

The test may be applied as follows:—To about two drachms of urine add a drachm of a saturated solution of picric acid; if there is a precipitate, the presence of albumin is indicated, and the solution should then be boiled, for boiling causes the albumin to coagulate. The coagulated albumin should then be removed by filtering, before the urine is further tested for the presence of sugar. Whether using Johnson's test or Fehling's, it is well to remove all albumin from the urine before attempting to test for the presence of sugar. If the urine contains no albumin, or the albumin has been removed as above, a little liquor potassæ should be added, and the mixture then boiled for a minute. If sugar is present, the mixture becomes very dark red, or even quite opaque, owing to the presence of picramic acid. Normal urine, when boiled with a solution of picric acid and liquor potassæ, becomes red but never a dark red.

There are certain fallacies, in connection with the tests mentioned above, which must be remembered. If a urine happens to be somewhat concentrated, and therefore contains urates, uric acid, hippuric acid, or creatinine in excess, there is sometimes a slight reduction of Fehling's solution on boiling, and a darkening when Johnson's test is applied. If a substance called glycuronic acid ($C_6H_{10}O_7$) is present in the urine, it will cause a reduction of the Fehling's solution, and will also bring about a slight darkening with picric acid and caustic potash when the mixture is boiled. There is a close relationship between dextrose and glycuronic acid, as may be seen by the following formulæ :—

$$\left.\begin{array}{c}\text{COH}\\(\text{CHOH})_4\\\text{CH}_2\text{OH}\end{array}\right\}\text{dextrose,}\qquad\qquad\left.\begin{array}{c}\text{COH}\\(\text{CHOH})_4\\\text{COOH}\end{array}\right\}\text{glycuronic acid ;}$$

and it is said that, occasionally, without any known cause, glycuronic acid may appear in the urine. After the administration of certain drugs, such as camphor, chloral hydrate, butyl-chloral hydrate, chloroform, morphia, phenacetin, nitrobenzol, and some of the quinine derivatives, glycuronic acid often appears in the urine, and may consequently reduce Fehling's solution, or give Johnson's test. Glycuronic acid is also dextro-rotatory. Should a reducing substance be detected in the urine, it is advisable to apply some confirmatory test, in order to make certain whether that substance is sugar or not. One or other of the following tests may be applied :—

Fermentation Test.— A U-shaped tube, closed at the end of a long limb, with the short limb opening into a small reservoir, is filled with the diabetic urine, to which a little yeast has been added. This is left in a warm place for twenty-four hours. The yeast causes the dextrose to break up into alcohol and carbon dioxide, some of the latter of which collects in the upper end of the long and closed limb of the tube. Recently, an instrument on this principle, now known as Einhorn's saccharometer tube, has been introduced, the longer limb of which is so graduated that the amount of sugar present in the urine may be readily ascertained.

The Phenyl-hydrazine Test.—To about 5 cubic centimetres of diabetic urine are added 1 decigramme of phenyl-hydrazine hydrochloride and 2 decigrammes of sodium acetate. The whole is then heated in a water-bath at 100° C. for half an hour. A crystalline, or amorphous, precipitate is produced. If the precipitate is amorphous, it must be dissolved in hot alcohol; water is then added to the solution, which must then be boiled; the alcohol is thus expelled, and a yellow crystalline precipitate separates out. The crystalline precipitate is phenyl-dextrosazone [$C_6H_{10}O_4(N_2HC_6H_5)_2$]. If the precipitate is examined with the microscope, it will be found to consist of bundles of fine yellow needle-shaped crystals. In a similar way, lactose may be detected in the urine by the formation of crystals of phenyl-lactosazone, although lactose in the urine does not give this test readily. The crystals of phenyl-lactosazone appear in the form of fine yellow needles, occurring in clusters.

Alkaptonuria, which may also be a source of error, is a rare condition, and, according to Garrod, is not the manifestation of a disease, but is rather of the nature of an alternative course of metabolism, harmless, and usually congenital, and lifelong. The chief point of interest of alkaptonuria is that the alkapton reduces Fehling's solution on boiling. It does not, however, ferment with yeast, and is optically inactive, whereas dextrose and lactose are dextro-rotatory.

ACETONE, DIACETIC ACID, β-OXYBUTYRIC ACID.—Besides containing dextrose, diabetic urine may contain the following substances, *acetone*, *diacetic acid*, and *β-oxybutyric acid*. Recent research has shown that the β-oxybutyric acid originates in the body from fat, and that it is the source of the diacetic acid and of the acetone.

Test for Acetone.—Add to the urine a solution of sodium nitro-prusside and a little 20 per cent. caustic potash; a red colour is produced; acidify with a little strong acetic acid; the red colour disappears at once in the absence of acetone, but remains, or is intensified, in its presence. Acetone may also be recognised by Lieber's test, "which consists in pouring the suspected urine upon a solution of iodide of potassium (gr. xx.), in liquor potassæ (ʒj.), boiled together. Phosphates are precipitated, and if acetone is present, the deposit afterwards becomes yellow, from the formation of iodoform, which also falls in the form of yellow granules."

Test for Ethyl-diacetic Acid.—Add to the urine a little ferric chloride solution, a red colour is produced if ethyl-diacetic acid is present. Other substances, such as carbolic acid, salicylic acid, and formic acid, give a similar colour-reaction in both fresh and previously boiled urine, while diacetic acid does not give the reaction in urine which has been previously boiled. In testing for ethyl-diacetic acid, fresh urine should be used, as it is readily broken up into acetone and carbonic acid.

Test for β-oxybutyric acid (or amino-hydroxybutyric acid).—It is now recognised that this acid is the cause of diabetic coma, and in all severe cases of diabetes, it should be examined for in the urine.

All the sugar present in the urine should be completely fermented with yeast, and then the urine should be examined with the polariscope. β-oxybutyric acid is lævo-rotatory. Moreover, the diabetic urine will indicate a greater percentage of sugar, detected by Fehling's solution than with the polariscope, for the lævo-rotatory power of the β-oxybutyric acid will neutralise some of the dextro-rotatory power of the dextrose.

DIET IN DIABETES MELLITUS.—In determining the proper diet for a patient suffering from diabetes, it is irrational to commence the treatment by cutting out from the daily dietary all carbohydrate food. Each case must be carefully considered with regard to the possible cause of the sugar in the urine. The blood plasma contains normally between ·12 and ·2 per cent. of dextrose, and, if that amount rises, the excess is simply excreted by the kidney cells. Errors in diet, such as overeating, may result in a temporary glycosuria, and such cases do well on a carefully restricted diet. There are other cases of diabetes, which certainly do not improve, but become undeniably considerably worse on a diet free from carbohydrate food. Sydenham taught as follows: "Let the patient eat food of easy digestion, such as veal, mutton, and the like, and abstain from all sorts of fruit and garden stuff." It is advisable, when commencing the dietetic treatment of a diabetic patient, to allow that patient, for four or five days, a diet containing a moderate and known amount of carbohydrate food, and each day to have the patient carefully weighed and the amount of dextrose eliminated estimated. For the next two days, the amount of carbohydrate material in the diet should be gradually diminished, and the effect on the patient's weight, and the amount of dextrose, excreted in the urine, should be noted. The patient may then be put on a diet practically free from carbohydrate, as recommended by von Noorden, and the result is that dextrose sometimes completely disappears from the urine in about four days. After a short period, a more liberal diet may be allowed, and the effect upon the patient's weight and the urine carefully noted. Amongst the *prohibited articles* of diet, Professor Osler mentions the following: Liver and soups which have been thickened with flour or sago, ordinary white or brown bread, farinaceous foods, such as rice, tapioca, hominy, semolina, arrowroot, sago, and vermicelli. Of vegetables, the following are not allowed:—Potatoes, parsnips, carrots, beetroots, artichokes, and corn. Beer, sparkling wines, and sweet aërated drinks should be prohibited. One of the most difficult things in dieting a diabetic patient is to find a substitute for bread and biscuits.

For ordinary bread, Messrs. Callard make a palatable casoid and casoid-meal loaf. Their prolacto biscuits, which are free from sugar and starch, made from albumin, and contain about 50 per cent. of albuminoid material, are crisp and agreeable, and may be taken in place of ordinary biscuits. Recently, too, they have introduced almond sponge cakes, sweetened with glycerine, which may be substituted for ordinary cake. At the same time, it is important that the physician should study the idiosyncrasies of his patient, for the diet, which will suit one patient, may be absolutely unfitted for another.

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Diabetic Coma.—This condition may set in, either early or late, in patients who are suffering from diabetes, and sometimes occurs quite unexpectedly. Frederick Roberts says: "It may result from the sudden and complete cutting off of the supply of drinking water; rapid change from anti-diabetic to ordinary diet, or *vice versâ;* prolonged exertion and excessive fatigue; mental excitement, anxiety, or shock, as from a fright; obstinate constipation; or some intercurrent disease." The cause is "acid-intoxication," or, as Naunyn calls it, "acidosis," and the substance which produces the coma is β-oxybutyric acid, which accumulates in the blood and tissues of the patient. The acetone and diacetic acid, which occur in the urine, are derivative products of the β-oxybutyric acid. As a rule, the coma sets in very rapidly, and is due to the action of the acid upon the cells of the brain. The phenomena are, usually, of a dyspnœic type, preceded by headache and restlessness, the breathing becomes deep and less frequent, the patient becomes drowsy, and finally passes into a profound coma. He usually becomes pale, but may sometimes be cyanotic. The pulse is small and rapid, and the temperature becomes subnormal. The characteristic odour of the breath, which has been likened to that of American apples, is, as a rule, very pronounced; the urine, too, yields a similar odour to that of the breath.

When coma is threatening, the patient should be given large doses of sodium bicarbonate, or potassium citrate, a good purge should be administered, and inhalations of oxygen given. If possible, the skin should be made to act by the use of vapour baths. Stimulants should be administered hypodermically, or by enemata. Normal saline solution, of the strength ·9 per cent. or a 1 to 2 per cent. solution of sodium bicarbonate, in normal saline solution, should be given either subcutaneously, or intravenously, in order to dilute the β-oxybutyric acid which is in the blood stream. In desperate cases, it is recommended that about one litre should be slowly injected into the median-basilic vein, or some other superficial vein, every six hours. If sodium bicarbonate is used, it should be continued, until the patient's urine becomes definitely alkaline. In order that the alkaline treatment may have a fair chance of success, it should, of course, be resorted to early in the stage of coma.

PERFORATING ULCER OF THE FOOT. — These ulcers usually occur on the sole of the foot, as a rule, beneath the base of the great toe. If due to a trophic lesion, they progress rapidly and deeply, and soon involve the bones and joints. There are two chief factors which cause these ulcers to arise, the one is local injury, such as may be caused by wearing tight boots, the other is anæsthesia of the soles, such as may be due to central nervous causes, these are tabes dorsalis, spina bifida, and syringomyelia. Peripheral neuritis is quite a frequent cause, and it may be brought about by chronic alcoholism, *diabetes mellitus*, and syphilis. Lastly, the anæsthesia may be due to an injury to the spinal cord, or to the peripheral nerves. Perhaps the commonest cause of a perforating ulcer of the foot is either diabetes, or tabes dorsalis. Whenever such an ulcer is discovered, the patient's eyes should be carefully examined for other signs of locomotor ataxia, and the urine should be carefully tested for a reducing sugar and acetone. A typical perforating ulcer has an orifice surrounded by a heaped-up and thickened cuticle, the sinus leads down to the deeper tissue. The discharge, as a rule, is slight, and there is little or no pain due to the local anæsthesia. If these ulcers are treated early, improvement usually takes place. The thickened mass of cuticle should be carefully cut away, the sinus cleaned by the use of local antiseptics, and the orifice of the ulcer and the parts around should be carefully protected from pressure.

THE PRACTITIONER.

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THE GUTHRIE LECTURE ON SOME RECENT RESEARCH WORK ON CANCER.[1]

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Of all the diseases to which the human race is liable, cancer is, I suppose, the most dreaded, by reason, doubtless, of its inexorableness ; of belief in the apparent impossibility of permanent eradication, even with the assistance of the most skilful surgery of the day ; and of the awful suffering so frequently concomitant with its progress to a fatal termination.

Naturally, therefore, the subject of cancer in all its bearings, its possible causation, its treatment, and, perchance prevention, has always loomed largely in the public eye, more especially so of recent years, possibly for the reason that the statistics of the Registrar-General would appear, at first sight, to afford conclusive evidence that the mortality from cancer, at the present day, is decidedly higher than was the case, say, fifty years ago.

I do not propose on this occasion to discuss in detail the question of such apparent increase of cancer, but will merely content myself with reference to the suggestion that any actual increase, supposing there to be any above that which is dependent on increase of population, may, in all probability, be set down to the greater expectation of life, in both sexes, which has been gradually brought about during the past half century, as the outcome of increased knowledge of practical sanitation. In other words, a greater average length of days tends to increase the prevalence of cancer for the reason that a greater number of persons tend to survive to what may be termed the "cancer age." Among those above the age of 35, now living, the chance of ultimately dying of cancer is 1 in 8 for women, and 1 in 12 for men. In certain industrial occupations it is much higher ; to the extent of 100 per cent. in chimney-sweeps, as shown in a recently published official return.

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[1] Delivered at the Westminster Hospital.

Whatever the precise reasons, the past five or six years have undoubtedly witnessed an extraordinary accession of practical interest in the subject, not only in the scientific world, but to an equal extent among the laity, headed by His Most Gracious Majesty the King ; which has found expression in the establishment of the Imperial Cancer Research Fund, and of a number of laboratories specially devoted to cancer research, not only in this country but also abroad, more particularly in Germany and America ; and in the raising of considerable sums of money for the further prosecution of research, especially of concerted experimental and statistical work on this disease.

I think that it will be generally agreed that Dr. Bashford, writing in 1903, was not overstating the case in saying that at that time our knowledge of malignant new growths was all but limited to a recognition of the facts which present themselves for investigation in pathological laboratories, obtaining their material from the *post-mortem*, or operating, theatres of hospitals in the most civilised portions of the world ; correlated though extensive investigation of such material, especially from the histological standpoint, had been, with clinical observations. And, in view of the present comparatively small outcome of the enormous amount of work that has been expended in this direction, it would seem that, not by these paths alone, will the problems of cancer be eventually solved.

But just at the psychical moment (in 1903) came the announcement of the discovery, first by Morau and Jensen, and subsequently by Borrel, of the possibility of carrying on, by experimental inoculation, a particular form of cancer, originally occurring spontaneously in the mouse, from one of these animals to another, through a practically unlimited number of generations; thus opening up a previously unexplored and most fascinating field for research. To a consideration of this work I propose to return presently.

In addition to the study of cancer from the point of view of clinical observation and of morbid anatomy, gross or minute, there presently became added, as the outcome of the work, in other fields, of Pasteur, Koch, and their pupils, the search for a specific infective micro-organism, the particular methods adopted in this connection varying as the general knowledge of bacteriology, and, more recently, of proto-zoology, became more exact. And cancer "parasites" innumerable, including bacteria, yeasts, protozoa, and many organisms, too peculiar, as a writer in one of the medical journals puts it, to be classed with any known species, have from time to time been "discovered."

Although the assumption that a parasitic origin of cancer cannot in the present state of our knowledge be held to be impossible, nevertheless the outcome of work in this direction is so indefinite that it would be unprofitable, and indeed impossible, in the time at my disposal, to dwell on the details of the majority of such observations; so that I will content myself with a brief reference to the widely contrasting work of Doyen, and of Plimmer.

It will be within the recollection of all here present that, within the last year or two, much has been heard, in the lay press especially, of a serum treatment for cancer devised by Dr. Doyen, of Paris. Investigated by a Committee of Surgeons appointed by the French Académie de Médecine, the method was declared to be practically useless, and a similar verdict has, I believe, been arrived at as the result of trial in this country. For the production of his serum, Doyen employed the injection into horses of cultures of a microbe, isolated by him from cancerous growths, to which he gave the name of *micrococcus neoformans*. He asserts that, if proper precautions are observed, there is little difficulty in isolating it from cases of malignant disease, and, in this respect, his observations have been in large measure confirmed, especially by workers in the Cancer Research Laboratories of Middlesex Hospital. Doyen lays considerable stress on the fact that the *micrococcus neoformans* is decidedly polymorphic, occurring as a staphylococcus, a diplococcus, or in groups of three, four, or more units, the diplococcus form being, in his opinion, that which is most frequently met with. This micro-organism grows fairly well on all the ordinary media of the laboratory, especially in broth, and on the surface of nutrient gelatine and blood-serum. Grown as a stab-culture in gelatine, it induces, in time, slight liquefaction of the upper surface of the medium. Morphologically and culturally indeed, it is with difficulty distinguishable from a common skin micro-organism, named by Welch the *S. epidermidis albus*. As might be expected, it is found most readily in material from the edge of a rapidly growing tumour, least so from one that is of slow growth and fibrous in texture. In attempts at its isolation, the method of inoculating a considerable number of broth tubes, ten, twenty, or even more in each instance, is obviously most likely to conduce to success. In these circumstances, it has been found possible to establish its presence in as large a proportion as 80 per cent. of all the undoubtedly cancerous growths examined. Consequently, although pathologists are agreed that the *S. neoformans* does not, as claimed by Doyen, represent the specific infective agent of malignant disease, it must, I think, nevertheless be considered as something more than a casual concomitant, a view that is borne out by certain observations of Sir A. Wright. The latter observer recently published an account of the treatment of an inoperable growth of the larynx by means of subcutaneous injections of *S. neoformans* vaccine, prepared and used in accordance with his well-known methods, including the periodical determination of the patient's opsonic index for this micro-organism. Although I believe that the patient ultimately succumbed to the disease, much temporary benefit appeared to accrue from the injections, a result which could perhaps hardly have been expected, unless the particular microbe in question had actually exerted some influence as regards the localised inflammatory condition. It is of course rash to draw conclusions from a single case, but in conjunction with the fact that demonstration of the presence of *S. neoformans*, in so large a percentage of malignant growths, has been obtained, it would appear not improbable that it may, as the causal agent of a terminal infection, exert a somewhat similar influence to that which has been attributed to the *diplococcus lenticularis*, isolated from cases of sleeping sickness by Castallane concurrently with the members of the Portuguese Commission, prior to the discovery of the actually specific agent of this disease, the *trypanosoma Gambiense*.

But the specific parasite of cancer, if such, indeed, exists, is still to be sought for.

The name of Plimmer will be permanently associated with the discovery and demonstration in cancer cells of certain "bodies," the precise nature and possible relationship of which are, as yet, matters of controversy. I may, perhaps, explain that, in properly prepared sections, Plimmer's "bodies" appear as clear vesicular structures in the cytoplasm of the cell, surrounded by a definite limiting membrane, and possessing a single centrally-situated dark spot. Appearances almost exactly comparable with Plimmer's "bodies," as Farmer, Moore, and Walker have pointed out in a series of papers, of which the first was read before the Royal Society in 1903, can be demonstrated in various stages of cell-division occurring in normal reproductive tissue. These same observers, in collaboration, had previously shown that, in cells adjoining the growing edge of a malignant tumour, the process of nuclear division differed, in several respects, from that of normal "somatic" cells. For instance, the number of chromosomes formed in the cancer cells was approximately only half that found in the ordinary body-cells of the same host, being, therefore, comparable with the number formed during the process of nuclear division in the cells of the reproductive glands. For these reasons, they have applied the term "gametoid" to the phenomena of cell-division in cancer, indicating thereby the similarity of the maiotic changes in one and the other case, although they are careful to guard themselves, for the present, against the assumption that the comparison is exact. On the other hand, Bashford and Murray, although originally accepting the correctness of the views of Farmer, Moore, and Walker in reference to the diminution in number of the chromosomes in cancer-cells, have since, as the result of further examination of their sections, found reason to withdraw their corroboration. In these circumstances, it is the more interesting to note that they have also placed on record certain observations, which seem to indicate that reproductive activity, as indicated by the conjugation of cell-nuclei, in some sort comparable with that which normally takes place in the fertilisation of the ovum, can, in special instances, be demonstrated in certain cells of "cancer" experimentally produced in mice.

Messrs. Farmer and Moore have also recorded the fact that evidence of conjugation between the nuclei of wandering leucocytes and of certain cancer cells, presumably those which have undergone the abnormal method of mitosis previously mentioned, has been observed by them in preparations from malignant growths.

What may be the precise interpretation or importance of these gametoid phenomena is, as yet, difficult to determine. But it is, perhaps, not improbable that they may represent the visible expression of an aberrent form of reproductive effort on the part of the organism, somewhat akin to that which, according to a statement in the recently published Report of the Woburn Experimental Fruit Farm, is not infrequently witnessed in the case of prematurely old, ailing, or injured trees, in which indication of their abnormal condition is apt to find expression in a tendency to the formation of an excessive number of reproductively defective fruit-buds.

EXPERIMENTAL CANCER IN MICE.

At this point we may conveniently turn to the consideration of those special methods of research, which have been rendered possible by the discovery, to which I have already alluded, that, in mice, certain malignant growths, especially of the mammary gland, are capable of being propagated, almost indefinitely, by the transplantation of minute portions of the tumour mass from one animal to another. For this purpose, minute cellular grafts, averaging not more than 0·02 gramme in weight, or about the size of an ordinary pin's head, usually suffice to initiate growth of a tumour, which, in the course of a few weeks, may practically double the original size and weight of the mouse.

Although the discovery, that it was possible experimentally to propagate certain mouse tumours, was apparently made by Morau in 1891, knowledge of, and interest in, his work remained dormant until it was confirmed, extended, and popularised by Jensen more than ten years later. The publication of Jensen's classical paper in 1903 was, as I have said, doubtless, in considerable measure responsible for the extensive studies of sporadic and experimental tumours of mice which have since been carried out by Borrel, Ehrlich, and Apolant, Haaland, Michaelis, Henke, Pick, and others abroad, and especially by Bashford, Murray, and Cramer, of the Imperial Cancer Research Laboratories in this country.

Jensen's original material was obtained from a tumour which occurred spontaneously in a white mouse. Portions of this were transplanted by him into other white mice, with successful results in from 30 to 60 per cent. of his experimental inoculations. Borrel, working with what appeared to be an adeno-carcinoma, also originally occurring in the mouse, recorded 10 per cent. only of successful results, while with certain other malignant new growths, likewise obtained from mice, his results were entirely negative. Similar experiences, as regards complete failure of transplantation experiments, have been recorded by the Cancer Research Fund, although, working with Jensen's tumour, their success rate, when large numbers of mice are employed, has varied between 20 and 100 per cent.

As the result of much careful and painstaking investigation, we have obtained knowledge of the fact that cancer is by no means confined to the human race, but is, as a matter of fact, widely distributed throughout the various vertebrate families of the animal kingdom, with the possible exception of the reptilia. Nevertheless there is, I believe, no instance on record of the successful transmission of cancer from man to the lower animals, or from one animal to another of different species; although, as Dr. Bashford points out, experiments have been repeatedly made to test the possibility of such transference, notably by Shattock and Ballance. The complete want of success, which has been found to attend experiments of this sort, Dr. Bashford seeks to explain as the result of cytotoxic activity, similar in nature to that which is observed when the blood-corpuscles of one animal are injected into another of a different species, the cytoplasm of the cancer cells being treated in similar fashion to any other proteids strange to the particular species into which they are transplanted.

But, as I have already stated, with certain sporadically occurring tumours of the mouse, such as Jensen's, when transplanted into other mice, the case is quite different, and the life of the tumour may be extended over an indefinite period, by repeated transference from mouse to mouse, quite independently of the ordinary span of life of individuals of the species on which it is parasitic, while the bulk of the tumour mass, capable of production in lineal descent from the original cellular graft employed for experimental purposes, would, in favourable circumstances, appear to be practically limitless. If these transplantable mouse tumours are indeed truly carcinomatous in nature, the fact of their ready experimental transmission obviously affords opportunity for comparative study of numerous problems in connection with the growth of malignant tumours in man, which, previously, were incapable of experimental investigation.

Thus, at the Cancer Research Laboratories, for instance, careful and continuous study of the naked eye and microscopical appearances at the site of transplantation in many hundreds of mice has been made. By killing the animals at varying intervals of time ranging from one hour onwards after inoculation, the sequence of development of the transplanted tumour material has been accurately followed, affording demonstration of the fact that the "inoculation" tumours are made up of the genealogical descendants of the cells experimentally introduced. The tissues of the host apparently provide the stroma of the tumour, but they take no part in the formation of the new parenchyma, so that the process would seem to be in no sense an infection.

These mouse tumours, moreover, are found, on occasion, to reproduce all the appearances characteristic of spontaneously occurring cancer, such as tissue-infiltration and metastasis, although owing to the looseness of the sub-cutaneous tissue in the mouse, they often reach a comparatively huge size without apparently giving rise to pain, or producing obvious symptoms of illness in their host. Thus, for instance, cachexia is absent, except in those cases in which ulceration of the skin over the tumour occurs, when emaciation, as evidenced specially by shrinkage of the tissues of the tail, usually becomes apparent within two or three days, and death speedily ensues.

As regards this point, I may remind you that Sir Samuel Wilks pointed out, nearly 40 years ago, as the result of experience gained in the performance of 2,000 necropsies at Guy's Hospital, that "the cachectic condition spoken of in cancer is a result of the disease, and does not pre-exist, in very many cases is not present at all, and depends upon accidental circumstances." I refer to this statement for the reason, especially, that the absence of cachexia in the experimental cancer of mice has been advanced by Roger Williams and others, as a reason for believing that the sporadic inoculable tumours of mice are not comparable with any form of human cancer, and that, consequently, information of value, bearing upon this disease in man, is not likely to be gained from their continued experimental investigation.

Dr. Lazarus Barlow, the Director of the Middlesex Hospital Cancer Research Laboratories, also does not regard Jensen's tumour as a true carcinoma, considering it, and similar tumours, to be endotheliomata-growths, of which nature, are of comparatively rare occurrence in the human subject. He further informs me that, so far as he is aware, no mouse tumours, the histological appearances of which may be considered strictly comparable with those of human cancer, have proved to be capable of successful transplantation into other mice.

These and other criticisms, to which it is impossible for me to even refer, on the present occasion, are fully dealt with by Drs. Bashford and Murray, in a paper published in *The Lancet* for March 23rd, 1907, to which I would direct the attention of anyone specially interested in this particular aspect of cancer.

CHEMISTRY.

The chemistry of malignant disease—which, in my belief, appears likely to afford one of the most fruitful fields for future research work—has been studied from many points of view, but to only one section of this vast subject will it be possible for me to refer in detail. Naturally, the organic and inorganic constituents of morbid growths have been carefully estimated, in the hope that it might be possible to demonstrate some qualitative or quantitative differences from those of normal tissues. In this connection may be mentioned a paper communicated to the Académie des Sciences, last year, by M. Odier, of Geneva, in which he directs attention to the existence of a definite parallelism between the glycogen content of a malignant growth and the activity of its cellular multiplication, a high ratio in the amount of glycogen present being accompanied by, and probably dependent on, a concomitant diminution of the glycolytic ferment in the blood. It remains to be seen whether these results and others of a like nature are corroborated as the result of subsequent observations.

It may be that some failure, or perversion, of internal secretion will prove to play an important part in the genesis of cancer, an indication of which is perhaps afforded by the work of Beatson on the influence exerted, by extirpation of the ovaries, in bringing about involution of cancer of the mammary gland. And, although as yet unproven, it would appear not improbable that the capacity for invasion and proliferation, which is so conspicuous a function of the malignant tumours, may presently prove to be dependent on the presence of a specific toxin or enzyme.

Again, the general body metabolism may be primarily at fault, a possibility which, as I think, the work on variations in production of gastric hydrochloric acid in cancer by Professor Benjamin Moore and his *collaborateurs*, and, more recently, by Dr. Morton Palmer, and by Dr. Wilson Hake and myself, has gone far to establish.

Since the year 1842, when Dr. Golding Bird, of Guy's Hospital, published in the *London Medical Gazette* what were probably the first observations on the subject, it has been known that free HCl can seldom be found in the contents of carcinomatous stomachs. It was not, however, until 37 years later, in 1879, that the subject commenced to attract attention, owing to the work of Ewald, and of R. von den Velden, since when, as the result of the work and criticism of many observers, absence of HCl in such cases has come to be regarded as a well-established fact; although, until recently, no satisfactory reason for the frequent absence of HCl had been put forward. It was to Professor Benjamin Moore and his *collaborateurs*, Messrs. Alexander, Kelly, and Roaf, that we owe the demonstration—a startling discovery—that in nearly all cases of cancer, wherever situated, the gastric HCl is either absent, or markedly diminished. Their first paper, read before the Royal Society on March 16th, 1905, related to observations on 17 cases of carcinoma affecting widely different situations in the body, while, in subsequent communications, this number has been raised to 34, controlled by further determinations of the acidity in 20 cases, not suffering from malignant disease, some of them perfectly normal individuals.

The material for examination was obtained by withdrawing the contents of the stomach, usually about an hour after giving a test meal, consisting, as recommended by Ewald, of a pint of tea, without sugar or milk, and a round of dry toast.

It would be wearisome and indeed impossible for me, in the time at my disposal, to describe the methods employed by these observers, as also by Dr. Morton Palmer, who, more recently, has generally confirmed their results in the course of an investigation comprising 18 cases of cancer and three normal individuals (medical students). Dr. Hake and I, though working with a different method, devised by Dr. Willcox, of St. Mary's Hospital, which we had previously employed in the course of a lengthy research, to which reference will be made later on, have been enabled to corroborate the results of these observers, finding, in each instance, obvious diminution of physiologically active HCl, with or without complete absence of free HCl, as indicated by the Gunzberg reaction.

Further important investigations by Moore and Wilson have demonstrated the fact that the alkalinity of the inorganic constituents of the blood-plasma is increased in cancer, a change to which is probably due the reduction in acid-secreting power of the stomach. In this connection, it is also worthy of note that the work of Loeb and others has shown that increase of alkalinity, up to a certain point, leads to increase of cell growth and pathological nuclear divisions in many of the lower organisms.

Reviewing the work of Prof. Moore and his colleagues, on the gastric secretion in cases of cancer in the human subject, it occurred to me that the recent development of experimental Cancer Research, to which I have already directed attention, afforded a means of accurate control of the results obtained in man ; and I proposed to Dr. Hake that he should join me in the investigation I had in contemplation. This involved the estimation of the amount of gastric HCl in mice, these being apparently the only animals in which, so far as our present knowledge extends, experimental transference of cancer can be readily accomplished.

The main object, which we have had in view in our experiments, has been to ascertain whether an increase or decrease of physiologically active HCl could be demonstrated in the stomachs of "cancer mice," with either ulcerated or non-ulcerated tumours, as compared with normal mice. And to render all our experiments strictly comparable, we have, with a few special exceptions, confined ourselves, as regards "cancer mice," to examination of the stomachs of mice which had developed typical "growths," as the result of transplantations of cell-grafts from Jensen's original tumour. Our first series of experiments, which extended over a period of about six months (Dec., 1905–June, 1906), involved the examination of over 500 stomachs in seven series, with an average number of 70 in each series, including all three classes—A (normal), B (non-ulcerated tumours), and C (ulcerated tumours). Dr. E. F. Bashford, Director of the Imperial Cancer Research Fund, to whom we are indebted for the necessary material, arranged that the mice should be killed one hour after a full meal of bread and milk, and that the stomachs should be sent to us for examination as speedily as possible after death.

In the immense amount of routine work involved, we have received valuable help from Mr. Bosworth, the Senior Assistant in Dr. Hake's Laboratory.

The method adopted for determining the physiologically active HCl was that, already referred to, as devised by Dr. Willcox, with such small modifications as seemed desirable for our special purpose. The *modus operandi* is as follows :—The stomachs, belonging respectively to Classes A, B, and C, are counted, weighed, and macerated in water for about 12 hours, filtered through fine linen, and the filtrate from each series made up to 200 cubic centimetres. The testing of this filtrate is carried out in the following manner :—(*a*) The *total chlorides* (inorganically and organically combined chlorine) are estimated by Volhard's method in 50 cubic centimetres. (*b*) 50 cubic centimetres are evaporated to dryness on a water-bath and charred at a gentle heat, after which the residual *inorganic chlorides* are determined by the same method. (*c*) The *total acidity* is determined in 50 cubic centimetres by titration with $\frac{N}{10}$ sodium hydrate solution, phenolphthalein being employed as the indicator. From these determinations are deduced :—

1. Physiologically active HCl = $(a - b)$.
2. Organic acids in terms of HCl = $[c - (a - b)]$.

Our results have been expressed as percentages of the average weight of the stomachs.

Taking into consideration the whole seven series of experiments, we have found, on the average, a decided *increase* of physiologically active HCl in the stomachs of Classes B (non-ulcerated tumours) and C (ulcerated tumours) over that in the case of Class A (normal mice) ; the increase amounting in some cases to as much as 50 per cent.

It is necessary to direct attention to the fact that, in these preliminary experiments, owing to the small amount of the contents of the mouse's stomach, the estimations were carried out on extracts of stomach contents *plus* stomach tissue, a fact which we, at first, thought might not improbably account for the interesting divergence between our results and those of previous observers who have worked with material removed, after feeding with test meals, from the stomachs of human beings suffering from malignant disease.

During the present year, thanks again to the kindly co-operation of Dr. Bashford, we have had the opportunity of dealing with a further large number of both normal and "cancer" mice, and in this second series, we have, as the result of our previous experience, been able to carry out separate, but parallel estimations, of the amount of HCl in the gastric contents and in the stomach tissues. The results we have obtained are, I think, of decided interest, demonstrating, as they do, that, in the stomach contents alone, the increase of gastric HCl in "cancer" mice is practically the same as that observed in our former series of experiments. At first sight, the results of our investigations would appear to show either (1) that our chemical methods are not properly comparable with those employed by Moore and others, or (2) that, biologically, Jensen's tumour is not to be regarded as comparable with cancer as met with naturally in the human subject. As regards the first possibility, I have already shown that such a criticism cannot be sustained; while, as to the second, Dr. Bashford has suggested that this increase in the amount of physiologically active HCl is to be regarded as a compensatory response to the needs of a mouse *plus* a tumour, the increase of HCl being required for the digestion of the increased amount of proteids needed for the building up of the abnormal amount of protoplasm involved in the continual production of new tumour cells. He further suggests that our findings, as to increase of HCl in "cancer mice," are not necessarily to be considered as out of accord with chemical observations on the human subject, since, in the one case, we are dealing with normal mice artificially made to bear tumours, and on the other, with patients, in which they have appeared spontaneously. In other words, the conditions of the growth of cancer are to be sharply distinguished from the conditions of its origin.

Obviously it is of the utmost importance that Dr. Bashford's assumption should be submitted to experimental test, and this he kindly proposes to give us material for attempting ; since the demonstration of its correctness or otherwise cannot but have an important bearing on much of the work carried out under the auspices of the Imperial Cancer Research Fund.

To this end, estimations of HCl in the stomachs of mice, the victims of spontaneous cancer, must be obtained—a matter of no slight difficulty even where large numbers of mice are available. This difficulty, however, Dr. Hake and I hope in course of time to surmount.

As the result of the research work, carried out on the gastric contents of patients suffering from cancer in situations other than the stomach, to which I have called attention, there can be no doubt that, in the majority of cases, careful quantative estimation will disclose a distinct diminution, or even complete absence, of the HCl. And this being so, it is not improbable that, even in those cases in which no such alteration of the normal secretion is obvious, in the first instance, at any rate, later investigations may disclose a progressive reduction ; the result obtained at different periods being found to depend on certain definite factors, among which I would suggest the nature of the cancerous growth, the stage at which it has arrived, and the rapidity of its evolution. But for the complete elucidation of these points, a lengthy series of observations, including multiple estimations of the HCl-content of the gastric juice, at regular intervals during the progress of each case, will be required.

In the light of the recent physiological research of Pawlaw and others abroad, and of Starling and Bayliss in this country, the demonstration of absence of HCl in the gastric contents in cancer cannot be regarded as merely a matter of academic interest ; indeed, in my opinion, it may not improbably be found to afford, in part, at any rate, a reasonable explanation of the profound nutritional disturbance often associated with the later stages of cancerous disease.

The work of these physiologists has experimentally demonstrated the remarkable fact that the different stages of the digestive process, carried out at various points during the passage of its contents along the alimentary canal, are, with the possible exception of gastric digestion, entirely independent of central nervous control, being brought about by agencies of a purely chemical nature automatically regulated *inter se.* Briefly stated, the sequence of events is as follows:—At varying intervals of time, after reception of food into the stomach, rhythmic dilation of the pylorus affords passage to the acid chyme, in small quantities at a time, into the duodenum; the rapidity and amount of such discharge depending directly on the alkalinity of the duodenal contents. The presence in the upper part of the duodenum of the acid products of gastric digestion induces the formation, in the cells of the mucous membrane of this portion of the intestine, of a non-proteid substance, to which Starling has given the name *secretin.* Absorbed into the blood, secretin, in due course, reaches the pancreas, stimulating that organ to energetic secretion of potent pancreatic juice. It would seem, moreover, that the amount of pancreatic juice secreted is directly proportional to the amount of secretin present; this in turn, being directly dependent on the amount of acid entering the intestine from the stomach.

If the orderly sequence of events which I have described is not maintained, the processes of digestion will tend to become greatly impaired, and consequently the importance of absence or even diminution of HCl in the stomach in cancer becomes obvious. In absence of gastric HCl, the bile and the succus entericus are likewise incapable, to a greater or less extent, of performing their normal share in the process of digestion, seeing that these secretions are also dependent on the formation and absorption of secretin. In the light of these facts, both the distaste for food and the progressive emaciation, which are not infrequently marked features of the disease, may to some extent be accounted for, although it is of course possible that, as is frequently asserted, these and other symptoms may be due to the presence in the circulating blood of a specific toxin elaborated as the result of the cell-activity of the cancerous growth. But I may perhaps remind you that, up to the present, investigators have completely failed to obtain any evidence as to the existence of this hypothetical specific toxin.

In connection with our consideration of these successive chemical reflexes, controlling the production of the various digestive juices, I cannot avoid referring to an observation by Frouin, to the effect that the secretion of succus entericus can apparently be evoked by the intravenous injection of succus entericus itself, or of an extract of intestinal mucous membrane. If this is so, it is at least equally possible, although, so far as I am aware, the point has not been established experimentally, that the injection of pancreatic juice, or a mixture of its component ferments, may prove capable of stimulating the pancreas into special activity, and of causing it to pour forth an increased amount of active pancreatic juice into the intestine ; although, owing to absence or diminution of HCl in the chyme, the process of manufacture and absorption of secretin, on which the functioning of the pancreas ordinarily depends, is in abeyance.

May it not be that we find here an explanation of any useful therapeutic effect, which may have been found to result from the so-called "trypsin treatment" of cancer, of which so much has been heard of late, especially in the columns of the lay press in this country and in America ? Although this highly-vaunted method of treatment has apparently been proved incapable, alone, of preventing the inevitably fatal termination of the disease, nevertheless, there is some reason for believing that, in certain instances, its employment has been of service, if only in the amelioration of pain and other symptoms. A reasonable explanation of any such useful effect of the exhibition of an active extract containing trypsin and amylopsin, may, I think, be found in temporary stimulation of intestinal digestion, mainly pancreatic ; and possibly also of some pancreatic internal secretion, which, as I have suggested, may be thought of as not unlikely to follow its administration, whether by subcutaneous, or intravenous, injection ; or even by the mouth.

TREATMENT.

Incidentally, I have referred to certain methods of treatment which have been advocated by their authors as specific ; but which, unfortunately, have not withstood the test of critical investigation. In those cases, in which the growth is accessible to the surgeon's knife, early and well-planned operative measures still afford the only reasonable prospect of a successful issue. But can nothing be done for patients, the subjects of "inoperable cancer," so termed, either because of the situation of the growth, or for the reason that the disease has only come under observation at too late a stage for surgical interference to be of any avail? Apart from the question of actual cure, is medicine absolutely powerless to afford any alleviation, other than by the use of narcotics, for instance? It has been well said that "the mistake is too often made, both in pathology and medicine, of concentrating attention on the local effects of disease, to the neglect of the general disturbance of which they are but an expression, with the result that treatment is likely to be symptomatic rather than rational." But, in view of the important discoveries of Pawlaw, and of Starling and Bayliss, as to the mutual dependence of the various chemical reflexes concerned in the processes of digestion, it is certainly, I think, desirable that we should take steps to supplement defects in the first link of this chain, by causing the patient to ingest, with each meal, such an amount of HCl as will compensate for any observed defective gastric secretion of this acid. And further, since there is reason for regarding loss of function, on the part of the oxyntic cells of the gastric mucous membrane, as, in turn, dependent on a diminution of H *ions* in the circulating blood, we should, I think, difficult though it undoubtedly is to artificially alter an existing level of metabolic equilibrium, endeavour, by providing for the continuous assimilation of minute quantities of acid, to bring about a lowering of that increased alkalinity in the reaction of the blood which is not improbably responsible, in turn, for the absence of HCl secretion in the stomach. With this object in view, I am now making trial of Metchnikoff's lactic acid milk, the living acid-producing bacilli in which are capable, according to this distinguished investigator, of gradually supplanting the pre-existing bacterial flora of the intestine, to such an extent that, as the result of their vital activity, the usually alkaline reaction of the fæces gradually tends to become neutral or even faintly acid. I may add that this "bacterial junket" has a high nutritive value, is readily digested, and, in a case of advanced cancer of the stomach, proved to be practically the only food capable of being assimilated.

Pending definite knowledge of the ultimate chemical changes in general body and cell metabolism, underlying the evolution of a malignant growth, I would advocate, in addition to any other means of treatment considered desirable, trial of these therapeutic methods,—coupled, for the purpose of determining their usefulness or otherwise, with frequent and careful control examinations of the blood, urine, and fæces,—methods which, whatever may ultimately prove to be their precise value, would seem to have reasonable basis for their employment on theoretical considerations.

CONCLUSIONS.

Finally, I may perhaps briefly indicate certain tentative conclusions for which I think justification is afforded by the results of recent research work.

These are as follows:—

That cancer is to some extent preventable.

That cancer is not, in the ordinary sense, an infection, there being no evidence that its onset and continued growth is due to any recognisable micro-organism.

That cancer constitutes the local manifestation of perverted body-metabolism, an indication of which is afforded by the failure of the normal HCl secreting function in the mucous membrane of the stomach.

That temporary amelioration of symptoms, with or without obvious retardation of growth, has been obtained in a certain number of instances, as the result of treatment of one and another kind; but,

That in the present state of our knowledge early and complete operative measures, where possible, afford the only satisfactory method of treatment at our command.

That, nevertheless, cancer occasionally disappears spontaneously, the tumour ceasing to grow, and eventually becoming absorbed.

That, consequently, there is reasonable hope that continued investigation and research may afford accurate knowledge of the conditions favourable to such spontaneous cure, and, further, that the indications thus afforded may eventuate in the discovery of a method of treatment specific for this disease.

THE SPREAD OF CANCER IN THE UPPER LIP, AND ITS INFLUENCE ON TREATMENT.

By G. LENTHAL CHEATLE, C.B., F.R.C.S.,
Surgeon to King's College Hospital.

[With Plates I.—IV.]

In previous numbers of The Practitioner and other Journals,[1] I have pointed out the distribution of cancer when it begins in the lower lip and angle of the mouth. In the same papers, I further indicated how that accurate knowledge appeared to me to render desirable certain alterations in the methods usually adopted for the removal of cancer from these parts. In this article, I demonstrate the distribution usually effected by cancer, when its genesis occurs in the upper lip, or in the skin which covers the cartilaginous part of the nose, and afterwards show how this exact knowledge appears to me to indicate the efficient method of removal of cancer from the region of the upper lip. The genesis of cancer in the upper lip is rare. Mr. C. W. Rowntree, in an analysis of 211 cases in which cancer began on the lips, found, that in only 6 had this disease begun on the upper lip.[2] For practical purposes, one can foretell accurately the area which will be occupied by a cancer of this particular region, and the forecast may be regarded in the nature of a law, and trusted as such.

There are three anatomical conditions, which complicate the spread of cancer in this region, and which do not concern the case of cancer in the lower lip or angle of the mouth.

(1) The early spread to the alveolar margin of the upper jaw, particularly when the disease begins in, or spreads into, the central part of the lip. The upper lip at this part is naturally shorter than elsewhere, and the lip is made smaller by the contracting newly-formed connective tissue which encircles and pervades cancer. Atrophy of the normal tissue will also accentuate the diminution in the natural size of the lip.

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[1] The Practitioner, July and December, 1906, *British Medical Journal*, April 18, 1903, and December 16, 1905.

[2] *Archives of the Middlesex Hospital*, Vol. VII.

(2) The relation of the disease to the Alæ Nasi and columella. When cancer begins in the upper lip, the columella is earlier invaded than the Alæ Nasi, see Figs. 2, 3, 5, and 6. The septal origin of the orbicularis oris forms an easy pathway for the disease to reach the columella.

(3) The presence of the facial groups of lymphatic glands. I may here say that the buccinator group would, if present, be included in the incisions which I make for removal of small cancers at the angle of the mouth. In my last paper, I did not mention the group, because it is not always present, and, if it were, it would be included in the incisions which I advised.

In my preceding papers published in THE PRACTITIONER, I took particular pains to show how intimate are the anatomical relations of the cutaneous facial muscles to the structures in the true skin. To save repetition, I now refer the reader to those papers: in so doing, it must not be inferred that the cutaneous muscles of the upper lip are less important in conducting the spreading disease than the cutaneous muscles elsewhere on the face; on the contrary, they are just as important, and it will be seen that my incisions are greatly influenced by the positions of these muscles, so that the muscles which are invaded by cancer must be included within the lines of the incisions. The important cutaneous muscles of this region are the Orbicularis Oris and its septal attachment, the Buccinator, the Depressor Alæ Nasi, Levator Labii superioris Alæque Nasi, Levator Labii superioris, Levator Anguli Oris, and the Zygomaticus Minor. The reader will see for himself how they are taken into consideration when the time comes for describing the positions and directions of the incisions.

Fig. 1 is a cancer of the upper lip. It is symmetrical, and the positions of limitation, at its outer margins, are very constant temporary boundaries in cases, in which cancer begins on the internal side of those boundaries, or when cancer invades the upper lip from their inner side. See the right upper lip in Fig. 2, and the left upper lip in Fig. 3. But I have not sufficient evidence to know whether the cancer is constantly temporarily limited at the same point when the disease spreads into the upper lip from the lower lip or angle of the mouth. The

Plate I.

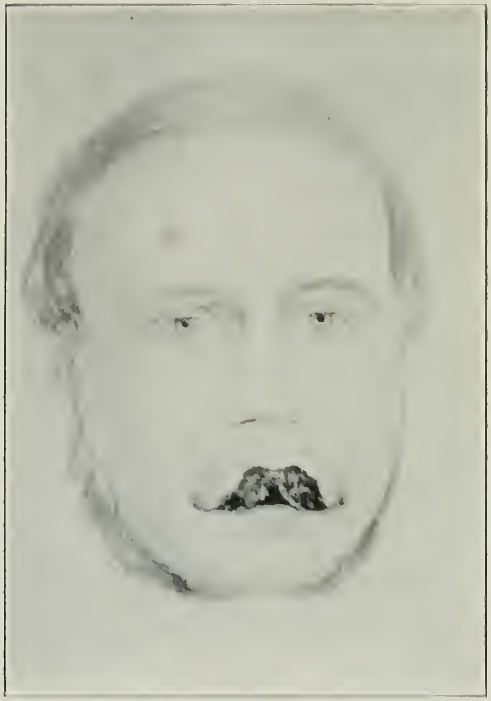

Fig. 1.—*Squamous epithelioma.*
Guy's Hospital Museum.

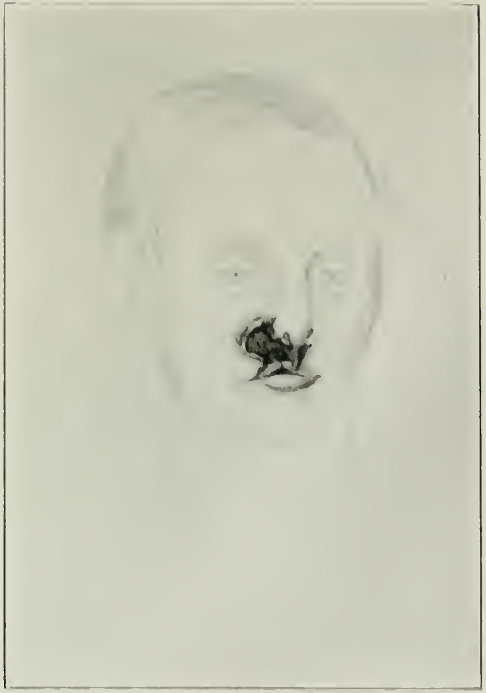

Fig. 2.—*Rodent ulcer.*
From the Museum of the Polyclinic.

PLATE II.

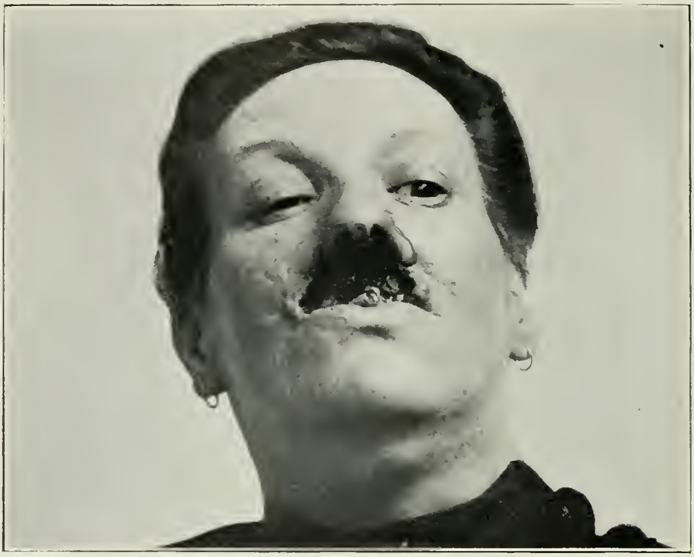

Fig. 3.—*Rodent ulcer. Middlesex Hospital Museum.*

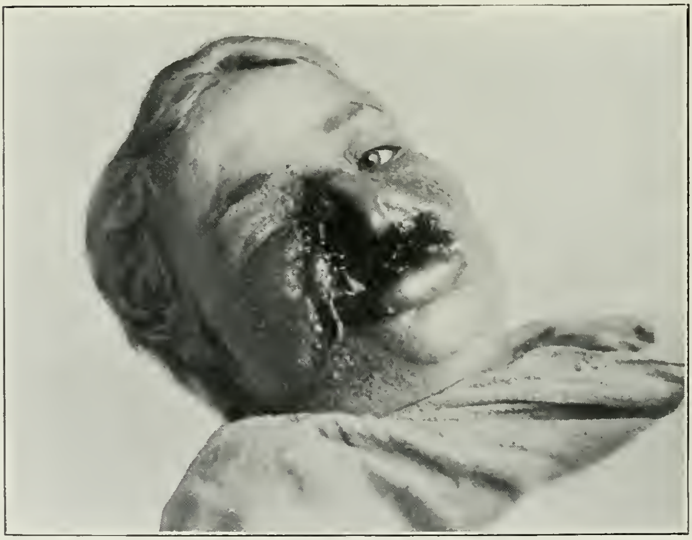

Fig. 5.—*Rodent ulcer. From the Museum of the Cancer Hospital.*

limitation is not seen on the buccal surface of the mucous membrane of the lip.

The reason for the marked limitation at this spot is not clear. It is the position of the inner edge of the Levator Labii superioris, and it also corresponds with the outer limit of the Levator Labii superioris alæque nasi, and also with the external limit of the parts supplied by infra-orbital nerve. Compare Fig. 2 with Fig. 4.[1]

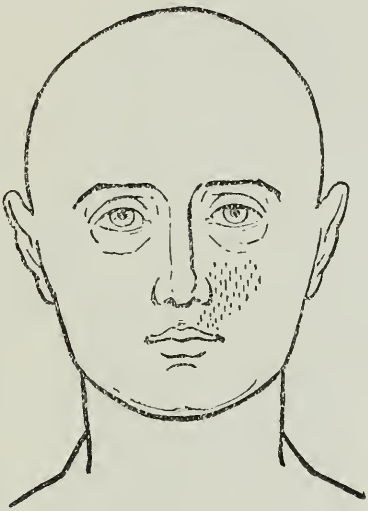

Fig. 4.

It is so usual a boundary that I make it the position of the external incisions, when removing a small cancer which begins in the centre of the upper lip, when there is little or no growth on the mucous membrane lining the mouth. See Fig. 9.

Figs. 3, 5 and 6 indicate a more advanced cancer of this region ; Fig. 6 still further indicates that the cancer will eventually spread along the whole of the lower lips. In Fig. 5 the disease has tracked up in the Levator Labii superioris alæque nasi, and also into the upper limits of the Levator Labii superioris, levator anguli oris, and zygomaticus minor ; the cancer is also spreading around the angle of the mouth in the orbicularis oris and buccinator muscles.

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[1] With Dr. Henry Head's kind permission Fig. 4 is taken from his article in *Brain*, Vol. XVII., "On the disturbances of sensation and pain in visceral disease."

To see how almost exactly alike in the details of their spread cancers can be, when occupying the same region, in different cases, it is interesting to compare the shape of the ulcers on the right sides of the mouths in Figs. 5 and 8. It will be observed, in Figs. 3, 5 and 6, that the nose survives until fairly late.

Fig. 7 represents an early case, the later distribution of which will be seen in the case of Fig. 8. The nose does not survive in this type of case.

It will be seen that these cases confirm my statement, made in the *British Medical Journal* for April 18, 1903, in which I said that the distribution is generally symmetrical, if it begins on, or even to one side of the middle line, and in which I suggested a possible relationship to the naso-labial nerve region described by Dr. Henry Head.

With regard to treatment, I intend to allude to small cancers only. All the pictures of cancer in this article represent cases in which the superior maxillæ, at least, would have to be more or less radically removed, were they deemed even operable. The comparative size, which I would call a small cancer, would be the size shown in the diagrams, in which my incisions are depicted. See Figs. 9 and 10.

I divide the treatment into excision and plastic stages, and finally describe the region in which the lymphatic glands must be sought for and removed if found. Before operating all unsound teeth must be removed, or stopped, and the mouth must be thoroughly cleansed for three days beforehand. And just before beginning the operation, the surface of the malignant ulcer is cauterised by means of the actual cautery which is applied, at a dull-red heat, until all bleeding has ceased. Great care must be taken during the operation to prevent the surface of the ulcer from coming into contact with the parts, from which it is being removed. And, lastly, the parts, which are in the process of removal, must not be squeezed nor subjected to any pressure that might dislocate the cells of the new growth which they contain. These three precautions are directed against the possibility of transplanting cancer cells on to the surface of the new wound.

I will first take the necessary steps to remove a small cancer of the upper lip. First make two lateral incisions,

PLATE III.

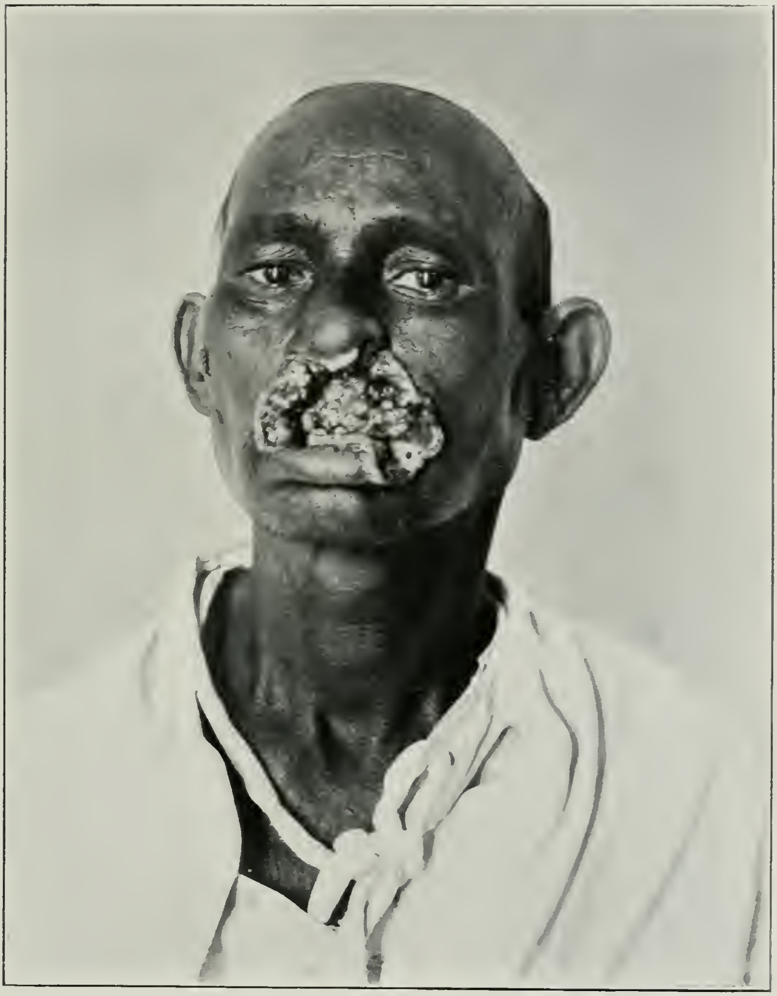

Fig. 6.—*Squamous epithelioma. Mr. F. C. Madden's case.*

PLATE IV.

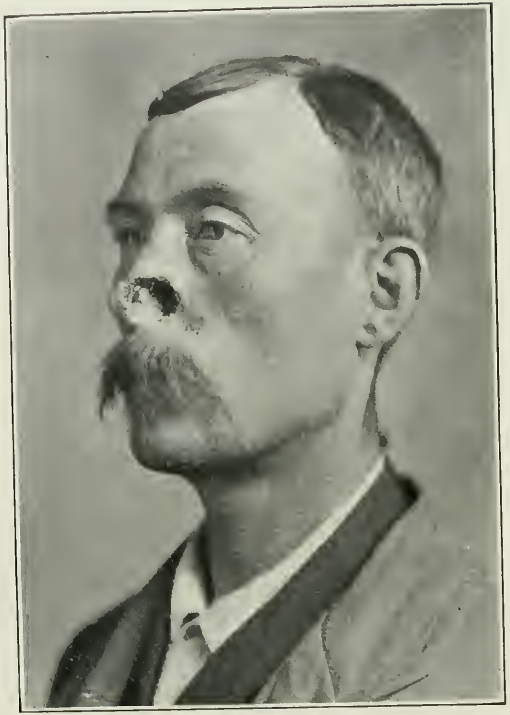

Fig. 7.—*Rodent ulcer.*

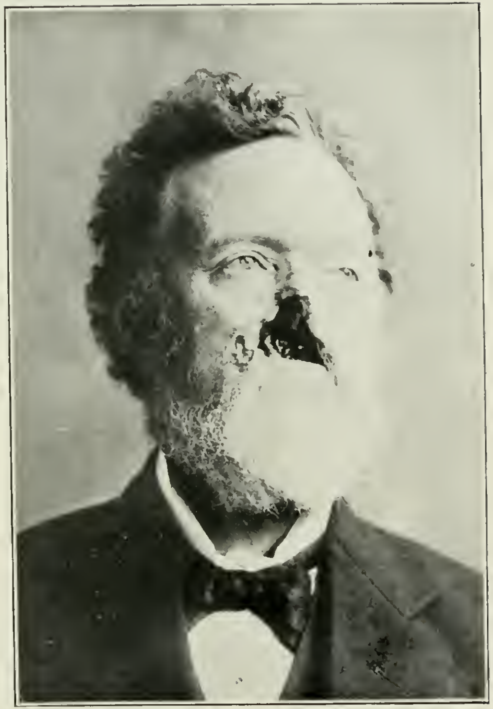

Fig. 8.—*Rodent ulcer. Dr. Sequeira's case.*

which must include all the structures of the part, and which start from the edge of the lip, covering the interval between the lateral incisor and the canine teeth, and are carried vertically upwards from these points to a level of the ala of each side. The ends of these two incisions are then continued into the cheek, by curving them outwards, the outward curves are to terminate where the ala of each side joins the side of the nose, see Fig. 9, and to include all structures to bone. The two incisions are then joined by a cut, which becomes transverse after curving round the grooves formed by the junction of the cheek with the ala of each side. In the transverse part of this incision, the base of the columella should be also removed, and the septal origin of the orbranlaus oris must be detached. Thus the shaded part of the diagram is removed. The Levator Labii superioris Alæque Nasi does not come into relation with a small cancer of this part of the lip. A new upper lip can be formed as follows:—Make on each side an incision an inch and a half long, which starts from the lateral incision at a point where the upward direction of it ceases, and the curved portion begins, see Fig. 9, and carry it downwards and outwards through all structures, and end it when it reaches the centre of the buccinator muscle. This incision must not involve Stenson's duct, the orifice of which can be easily seen in the mouth and avoided. These lateral incisions

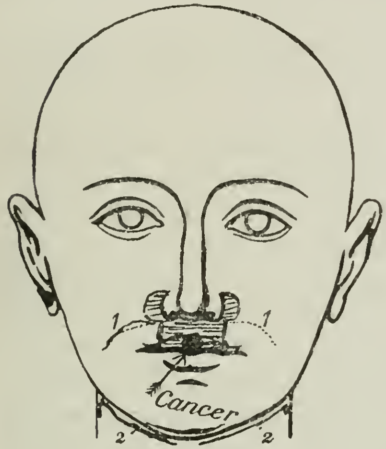

Fig. 9.

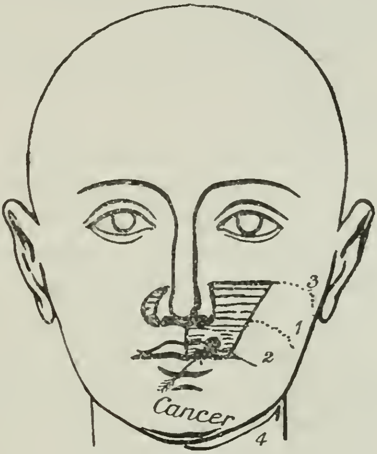

Fig. 10.

1, 1, Fig. 9, besides forming half a new lip, will also enable the surgeon to look for, and remove, if present, the buccinator group of lymphatic glands. The free ends of the new lip thus formed can be sutured across the middle line, and finally, the cheeks can be sutured to the alæ nasi. These steps are rendered much easier by thoroughly undercutting the attachments of the cheeks to bone. It will be necessary to remove the sub-maxillary lymphatic glands of both sides and also the supra-maxillary.

Secondly, I will describe the necessary steps to excise a small cancer growing in the centre of one side of the lip, see Fig. 10.

The lateral incisions in this case are different. The internal is directly vertically upwards, through all structures down to bone, in the middle line into the base of the columella. The external incision is carried (through all structures down to bone), obliquely upwards and outwards from the angle of the mouth towards the external canthus of the eye, but ends when it reaches the level, where the ala joins the side of the nose. This incision must be made obliquely outwards to include the zygomaticus minor muscle. The third incision joins the two previous ones by passing transversely inwards through all structures down to bone, from the end of the second incision to the junction of the ala with the side of the nose. This incision includes the attachments to bone of the Levator labii superioris, the Levator anguli oris, the zygomaticus minor muscles. It cuts across the continuity of the fibres of the Levator labii superioris alæque nasi. This incision will also include the lymphatic gland which may be found in the naso-genial groove. The incision is then continued downwards in the groove formed by the junction of the ala with the cheek, and ends by cutting through across the junction of the upper lip to the nose, so as to include half of the base of the columella and the septal origin of the orbicular oris. The incisions include the shaded portion of Fig. 10. The remaining half of the lip must be a great source of supply for the tissues which are to cover the gap thus made. All its attachments to bone, and to the base of the nose, must be divided, and an elliptical piece of skin must be removed from around the ala of the normal side, see Fig. 10. These proceedings will enable the remaining half of the lip to be drawn across the gap, and without interfering with the appearance of the nose. The upper lip can be formed, and the buccinator glands can be sought for, and (if present) removed, by making an incision, which includes all structures, and which starts from the external incision at the level of the junction of the ala with the lip, and ends by carrying it in a downward and outward direction until it reaches the centre of the buccinator muscle, see 1, Fig. 10. In order to prevent undue puckering at the angle of the mouth, it may be necessary to make an incision into the cheek, which is directed downwards and outwards, parallel with the last incision from the angle of the mouth, see 2, Fig. 10, so that it can be drawn inwards without pulling on the mouth. In order to cover the interval beside the nose, a third incision, parallel with the two last, must be made in the cheek from the top angle of the gap, 3, Fig. 10, the tissue of the cheek thus separated must then be brought inwards and stitched to the ala. The two parts of the lip are then stitched together, and finally the incision at the angle of the mouth is closed.

The lymphatic glands which are constantly present, and which can always be found, are the sub-maxillary glands, into which lymphatics from the upper lip drain, but, before reaching them, the lymph stream from the upper lip may pass through a buccinator group which is present 10 times in 32 subjects (Princetaux).[1]

I have dealt with the buccinator group, in describing the necessary steps in the formation of the new lips. There is one other group of glands, the supra-maxillary, which must (ii found) be removed, which can be satisfactorily performed when the sub-maxillary group is being removed. The sub-maxillary group are taken away through an incision made below the inferior border of the lower jaw from below the symphisis to the anterior border of the sterno-mastoid. The supra-maxillary glands can be reached by dissecting up the upper edge of this incision, and exposing their position on the horizontal ramus of the jaw in front of the attachment of the masseter. In cancers, at or near the middle of the upper lip, the supra-maxillary and sub-maxillary of both sides must be removed.

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[1] See *The Lymphatics*, by P. Poirier and B. Cuneo, translated and edited by Cecil H. Leaf.

See 2, 2, Fig. 9. In cancers, on one side of the upper lip, the supra-maxillary and sub-maxillary of the same side must be removed (see 4, Fig. 10). And, if the glands of the normal side are enlarged, they also must be excised.

In the two cases, from which I excised cancer from the angle of the mouth, and removed with it the site of the buccinator group, I could not find any trace of a lymphatic gland during a most careful dissection of the excised parts. In one case, microscopical sections, which were made of the whole parts removed, revealed total absence of lymphatic glands in this region. In most cases of squamous epithelioma in the region of the lips, it is generally late in the disease that the lymphatic glands are cancer containing. The lymphatic glands become enlarged quite early, but their enlargement is generally due to a great proliferation of the endothelial cells, masses of which can be seen spreading among, and isolating patches of, the normal lymphoid tissue of the glands. Therefore, although glands may be enlarged in lip cancer, they are not necessarily cancer-bearing.

THE DIAGNOSIS OF ADDISON'S DISEASE.[1]

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Recent progress in the treatment of disease has accentuated the importance of early recognition of the site of the affected tissues, and the nature of the morbid process attacking the organ.

It is easy to understand that the earlier the case is seen, the more difficult the diagnosis, and the less likely will the inspection of the tongue, along with the laying on of hands, lead to the correct solution of a complex problem. If diseases which cure themselves, along with a few others such as syphilis, malaria, and myxœdema, are excluded, the general rule holds, that advanced condition of organic disease can be but slightly ameliorated by medical treatment, and the quack alone claims to cure.

Addison's disease may be defined as a condition, which gives rise to a definite series of signs and symptoms, and, in the majority of cases, marked lesions of the medulla of the suprarenal gland are found at the autopsy. In some apparently typical cases, these glands prove to be healthy, not only upon macroscopic and microscopic examination, but also when the potency of their extract is tested physiologically.

Frequently in these, disease of the solar plexus can be demonstrated, and the explanation of the observation may lie in the fact that the internal secretion of the medulla of the suprarenal gland acts by stimulating the sympathetic system, for it is quite comprehensible that the effects of destruction of the sympathetic system, or of the producer of the activator of that system, will lead to identical trains of symptoms, and therefore the two conditions will resemble one another very closely. Along with the sympathetic nerves in the abdomen, in some immature animals, is a series of cells which have been termed chromaffine cells, because they yield a yellow colour on treatment with chromic acid. The intensity of the colour developed is said to bear a definite direct relation to the activity of the extract prepared from the tissue, and the effect, following the injection of the extract, cannot be distinguished from that produced by the injection of an extract of the medulla of suprarenal gland.

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[1] Read before the Royal Medical and Chirurgical Society.

It is the assumption of the duties of the suprarenal gland by the chromaffine cells, in the same way as the parathyroid glands take over the function of the thyroid gland after its extirpation, I venture to suggest, as the explanation of the cases, in which the signs of suprarenal inadequacy have been absent, in spite of the gland having been completely destroyed by disease.

The cortex of the suprarenal gland is developed from quite a different series of cells from that of the medulla, namely, those, which ultimately give rise to the genito-urinary apparatus, and do not manufacture a hormone for the sympathetic system, but possibly one which controls the development of the reproductive system. Evidence of this was presented in a paper by Sequeira and Bulloch on the relation of adrenals to the sexual organs, but physiological observations have not, until now, corroborated this.

The pathognomonic signs and symptoms of Addison's disease are asthenia, pigmentation, vomiting, and attacks of faintness. When all the symptoms are well marked, diagnosis is not difficult, but, by the time these are evident, the chances of any treatment being applied successfully is at least remote. Possibly some day the methods of transplantation, which have been devised and used with such success upon animals by Guthrie and Carrel, will be applied to man. If this is the case, early diagnosis will still be essential, for it is found that grafting can be successfully accomplished in animals, when tissue similar to the graft is already in the animal, but if this normal tissue is removed before the graft is made, the transplanted tissue is absorbed, and cannot take over the function of the extirpated organ.

PIGMENTATION.

Pigmentation is the most obvious sign of the disease, although far from the most pathognomonic, for there are cases of Addison's disease which do not develop pigment, whilst development of pigment may occur in many other conditions. The pigmentation in Addison's disease is usually an increase in depth of tint of those parts of the body which are normally dark, along with patches of pigment upon mucous surfaces.

The parts subjected to light or irritation, such as the face and hands, and the axillæ, and groins are often the first to show definite darkening. Where the shoulder straps, or braces, cross the shoulders, or the garter encircles the leg, pigmented bands may be seen, which, if they do not yield to repeated applications of soap and water, are suggestive of the disease. It must be borne in mind that these are often present in brunettes, but rapidly disappear when the patient is confined to bed, and the source of irritation removed. The scalp and nails usually escape, although the latter may be affected in advanced cases which have run a chronic course. Often brown spots may be seen distributed irregularly over the limbs and trunk. Scars are usually pigmented, but may escape with only a dark halo.

Pigmentation of the mucous membrane was at one time considered of exceptional diagnostic value, but I have seen similar pigmentation in patients, who have not had, nor developed any further signs of Addison's disease.

The conditions, which must not be confused with the pigmentation due to suprarenal insufficiency, are numerous.

1. The pigmentation accompanying pregnancy.
2. The increased pigment occurring in chronic tuberculosis.
3. Vagabond's disease in which the skin becomes dark from continued irritation.
4. Von Recklinghausen's disease.
5. Hæmochromatosis.
6. Exophthalmic goitre.
7. Pigmentation due to the prolonged ingestion of arsenic.
8. Argyria.
9. The darkening of the arms and upper part of body in men exposed to heat, such as occurs among stokers.
10. The pigmentation arising amongst workers in some chemical factories, especially those engaged upon anthracene compounds.

11. Melanasma accompanying melanotic sarcoma.
12. Freckles; similar in some respects to Kaposi's disease.

There are other conditions which are accompanied by considerable increase in pigment, but the above are the commoner, and, in the majority of cases, may be distinguished from melanasma suprarenale by careful observation; the main points will be dealt with in order.

The pigmentation associated with pregnancy is usually of but recent date, but may of course be accompanied by vomiting and a languor which makes definite exclusion of Addison's disease (by the usual methods) far from easy. The increase of pigment, occurring in advanced chronic tuberculosis, may be due, in a certain number of cases, to the adrenal glands becoming affected, and in those it may be impossible to distinguish it from the ordinary typical disease, but, in the majority, without suprarenal destruction, the pigmentation is much more uniform.

Vagabond's disease usually permits of ocular demonstration of the cause of the irritation, and on removal of the cause the pigmentation gradually fades.

Von Recklinghausen's disease presents very varying aspects, occasionally the pigmentation is marked, whilst the other skin alterations and the neurofibromata can only be detected upon minute examination.

Hæmochromatosis is a rare disease; the pigmentation is often, but not invariably, associated with glycosuria and cirrhosis of the liver; occasionally may be detected during life.

Exophthalmic goitre is usually associated with increased sweating, and this is said to cause pigmentation through irritation. The nature of the pigmentation is very similar to that of Addison's disease, but the other symptoms permit of the differential diagnosis.

Pigmentation, due to arsenic, in my experience, simulates most closely that of suprarenal disease, and cannot be distinguished from it merely by inspection. There are many methods of differentiating, but, with those, we shall deal later.

Argyria presents a very different colour to the pigmentation in Addison's disease. The parts exposed to light are of the deepest colour, and this colour is slate-grey, and not brown. The darkening of the skin, due to exposure to heat, does not, as a rule, present much difficulty, for the lower part of the body is usually normal in colour, since stokers are in the habit of wearing trousers whilst at work.

Melanasma, due to melanotic sarcoma, is usually uniform, and, in the majority of cases, the primary lesion can be found. When this is not possible the differential diagnosis is often difficult.

Kaposi's disease, in its typical form, leads to the development of epitheliomata, but there seems to be a number of varieties of different malignancy. I have seen such a close crop of freckles that the face of a dark brown colour seemed to betoken an advanced case of Addison's disease, whilst the pigmentation in the mouth, resembled that of melanotic sarcoma, being intensely black and extremely patchy.

ASTHENIA.

The commonest early symptom is a lack of desire to do work, either mental or physical, but this condition is unfortunately not confined to the disease under discussion.

The rapid fatiguing of the muscles is occasionally sufficiently well marked to be pathognomonic of the disease, whilst, in the less pronounced cases, graphic record may assist.

Langlois has laid great stress upon the value of the ergograph in the diagnosis of suprarenal inadequacy.

It was found that the power of the muscle to contract two or three times was not far below normal, but the power diminished very rapidly. For instance, a patient, suffering from advanced suprarenal inadequacy, might raise 5 klg. through 20 cm. three or four times, and then the distance would decrease to 15 cm., then to 13 cm., and gradually fall so that the fifteenth contraction might be so small as not to be visible. This form of ergographic tracing contrasts strongly with that obtained in phthisis and other wasting diseases. In them the initial contraction is weak, but the diminution in the succeeding efforts is but slight, and the general form of the tracing obtained is similar to that in health, but of course on a different level. Very great care must be taken in using this method, especially when applying it to female patients, for they not infrequently require considerable verbal stimulus to make them call forth their maximum power, and it is far from a rare thing to obtain typical myasthenic curves due entirely to laziness, and not to muscular weakness.

When an ergograph has not been obtainable, I have made the patient squeeze my hand repeatedly, at intervals of two seconds; in normal cases, the diminution of force is but slow, whilst, in well-marked cases of Addison's disease, it is most definite. It is not at all uncommon, however, to find that the muscular power is only diminished at times, and for quite long periods the patient's muscles act normally. On one occasion, after a man had squeezed my right hand some dozen times, I asked him to squeeze my left, and this he did with so much vigour that I felt the effects of his efforts the next day, although he then appeared on the post-mortem table, and presented adrenal glands destroyed by tuberculous invasion. Whether this rapid onset of fatigue is due to muscular ischæmia, or to the development of some toxin, is still under discussion. Watson's observation, that the adrenals of wild rats are relatively three times as big as those of tame rats, suggests that the glands manufacture something which is of direct use to the muscle; whilst, in myasthenia gravis, we must seek some other cause of weakness than poor blood supply to muscle, or suprarenal inadequacy. The adverse criticism of one method does not enhance another, but, nevertheless, this fact is not sufficient cause for suppression of experience, and, on the whole, the ergograph method of diagnosing Addison's disease, in my hands, has proved disappointing.

VASCULAR SYSTEM.

Since Addison's disease is due to interference with the sympathetic system, and it is through this that the vascular mechanism is controlled, one would expect a very considerable alteration in blood pressure; and one's expectations are fully realised. It is often possible to diagnose the condition from the pulse alone, for it is usually weak, and of extremely low pressure. The alteration of this pressure under treatment has assisted me in diagnosis, but, for that purpose, the estimation must be made with considerable accuracy.

It has been stated that attempts to estimate accurately blood pressure with the finger are as futile as those to determine temperature with the hand. Even the most experienced physician may be absolutely wrong in his estimation of the blood pressure in an artery, when he uses his fingers alone, however well trained they may be. This is not difficult to understand, when one remembers that the pressure required to occlude a vessel not only depends upon the pressure of blood in that vessel, but also varies directly as the square of the radius of the vessel. A small radial artery with a high internal pressure will be occluded with but slight pressure, and this was well brought home to me in a case of hemiplegia, in which there was universal accord that the condition was due to cerebral thrombosis, because of the apparently low blood pressure. On measuring the pressure with an instrument, it was found to be 195 mm. Hg., or more than half as much again as the normal.

The best method of measuring blood pressure is with the Hill and Barnard sphygmomanometer with a mercury or simple air manometer. It is of no little interest to see how the tendency of the Englishman to enhance the value of the foreigner's work has led to the instrument being termed the Riva-Rocci, although that observer published his work in a comparatively obscure Italian journal but a few months before Hill and Barnard perfected their apparatus.

In estimating the blood pressure, the patient should be set at ease, physically and mentally. An extensible air-tight bag of not less than four inches in breadth should be applied to the upper arm so as to encircle it completely, and be supported externally by an inelastic cover. Air is then pumped into the bag, which is connected with a manometer, and the pressure noted when the pulse just ceases to be palpable at the wrist. The patient is then told to take a few deep breaths, and usually, if the pressure has been only just sufficient to occlude the artery, an occasional throb may be felt in the radial artery. The pressure is then raised another millimeter or two, and, at this pressure, the pulse is obliterated even on deep respiration. The reading of the manometer is recorded as the systolic pressure in the brachial artery. Although fully recognising the importance of the diastolic pressure, when working at hæmodynamic problems, for the special diagnostic purpose in view I did not consider it essential. It is wise to make the patient assume a recumbent position before taking the observations, in order that the heart, bag, and wrist may be in the same horizontal plane. Speed in work is always valuable, so long as it is not indulged in at the expense of accuracy, and, in the above estimations, it is essential, for, if the pressure is maintained in the bag for any considerable period, the forearm becomes hyperæmic and very uncomfortable, and even a purpuric eruption may follow due to rupture of small vessels.

In Addison's disease, the systolic pressure is usually low, less than 100 mm. Hg. In one case I found it to be 67 mm. Hg.

In 1898, I carried out a series of experiments with the object of determining whether extract of suprarenal might be used as a hæmostatic in hæmatemesis, and found that even large quantities, administered by the mouth, did not lead to any recognisable rise in blood pressure in normal individuals. So far as I know, this observation has only been contradicted by one observer, who found that, on administration of 5 grains of dried gland thrice daily, a slight evanescent rise of blood pressure might be recorded after several days. It has been shown that, if animals are fed with adrenalin for some time, there is fatty degeneration of the organs with the exception of the kidneys and liver, proving that some toxic body is absorbed, but, even if large doses are administered to dogs by the mouth, a rise of blood pressure cannot be demonstrated.

It has been my rule to take the blood pressure, on at least three occasions, in all cases suspected of suprarenal inadequacy, and, if the blood pressure has proved to be low, suprarenal extract has been administered by the mouth. In many cases, this has been followed by a very distinct rise in the pressure. These cases have proved to be suffering from Addison's disease.

It was found that, in those cases which were pigmented from other reasons, the blood pressure was not raised on administration of the drug. The results have been sufficiently constant to permit me to base diagnosis upon the following method :—

The blood pressure is estimated upon three occasions, and the heart is examined to determine whether there is any valvular lesion. If the pressure is low and there is no valvular lesion, a trustworthy extract of suprarenal gland is administered three times a day, in doses of three grains, for three days. The blood pressure is then estimated again, and, if there is a rise of more than 10 per cent., the probability that the patient is suffering from adrenal insufficiency approaches a certainty. It is scarcely necessary for me to mention that no other drugs must be taken for at least three days before the first observation is made. Not infrequently a patient with a low pressure does not react to suprarenal gland but does to strychnine, this, if of value at all, is additional evidence against the probability of the disease being Addison's.

BLOOD.

It is very doubtful whether any alteration in the condition of the blood occurs in Addison's disease. The hæmoglobin often remains of normal quantity, and the number of red cells is not diminished. In a few cases, but it is doubtful whether these are uncomplicated, an increase in the number of white cells has been recorded, and, upon differential count, the number of lymphocytes has been found to be above the normal, and the polynuclear cells diminished. It has been asserted that the eosinophil cells are present in larger numbers than normal, but this is not infrequently the case after an inoculation of tuberculin, and does not permit of any conclusion being drawn, since it may arise from auto-inoculation.

Having arrived at the conclusion that the suprarenal glands are diseased, the next question which must be decided is the nature of the morbid process which is taking place in them. Undoubtedly the commonest cause of destruction is invasion of the tubercle bacillus, although, in the small series which I have had the opportunity of observing, I think at least one has been due to some other condition. Not infrequently this infection of the suprarenal gland takes place without any macroscopic evidence of tuberculous disease in any other part of the body, and examination of the lung often, therefore, fails to assist in deciding the nature of the invasion of the adrenals.

Comparatively recently the opsonic index of the serum for the tubercle bacillus has been used to assist diagnosis. In health, it has been shown that the variation of the index is limited from ·8 to 1·2 whilst in tuberculosis it may be between these limits, but is often above and below, and if the blood of the patient, suffering from tuberculosis, is examined from time to time, the index will be found to vary considerably. It has been asserted that, if the index is high, the opsonin is not destroyed at 60° C. in the blood of patients who are suffering from tuberculosis, whilst the opsonin, in non-tuberculous cases, cannot withstand this temperature. I find upon enquiry that this method has yielded very different results in the hands of different investigators, all of whom, in my opinion, were equally skilled.

Probably the most trustworthy method is by noting the opsonic index, and then determining, by repeated examination of the blood, the duration of the negative phase which follows an injection of a five hundredth of a milligram of tuberculin. In the majority of normal individuals, the negative phase is of short duration, 24 hours or less, whilst, in the hosts of the tubercle bacillus, it is prolonged, and may even be for a period of three weeks. I admit that the number of cases, in which the opsonic index has been estimated, is too small to permit of any conclusion, and this is primarily because Addison's disease is rare even in a large hospital, and, since this method has been in use, but few cases have been admitted. There is no reason to believe that the treatment with tuberculin would be less efficient in preventing the progress of the disease, than in other cases, in which the invasion is but local, such as in tuberculous glands of the neck, but so far this is purely speculative, and I have not had opportunity of seeing it carried out in any case.

A few minor signs are of value in the diagnosis of the disease, but to which system they should be ascribed is not clear. It is not uncommon for advanced cases to complain of flashes of light, which seem to be of very short duration, and do not assume the hallucinatory appearance which is described in teichopsia.

Vomiting is often a distressing symptom which cannot be controlled by any of the usual methods. Occasionally it is attributed to the exhibition of suprarenal gland, but cessation of the administration of the gland does not cause relief of the symptom. Constipation is very often difficult to deal with, because asthenia attacks the plain muscles as well as the striped muscle, and the usual stimulants of that tissue apparently do not act.

PROTOCOLS OF A FEW CASES.

Jane B., age 37. Ill about three years. Has been gradually getting darker during that time. Repeated vomiting during last five months. Nails pigmented, lines of palms dark. Pigment in the mucous membrane of mouth and lips; many brown spots distributed over trunk and limbs. Scalp apparently normal. Myasthenic action not at all well marked. Pulse low tension 72 mm. Hg. 88 per minute. On administration of 3 grains of suprarenal powder, three times a day, the blood pressure rose to 84 mm. Hg., but fell again to 68 on ceasing the drug. This fall of blood pressure occurred more than three weeks before death, and therefore could not have been due to a terminal paralysis of the vaso-motor centre. The opsonic index for tubercle bacillus was found to be (by Dr. Bulloch) ·52. The autopsy revealed complete destruction of the suprarenal glands by tuberculous disease.

Thomas B., age 21. Has become darker during the last 11 months, and is now so far pigmented as to have been a source of interest to the other inmates of Rowton House. He suffers from attacks of giddiness and fainting, vomiting, and diarrhœa. Patches of pigmentation may be seen in the mouth, and a scar from an operation is of deeper colour than the surrounding skin. The blood pressure was found to be 96 mm. Hg., which rose to 124 mm. Hg. whilst under the influence of suprarenal extract. On one occasion, the blood pressure was found to have fallen, and, on making inquiry, I learnt that the drug had been omitted for 24 hours. On readministering the extract, the blood pressure returned to 124, a pressure which was maintained during the patient's stay at the hospital. In this case the opsonic index tubercle bacillus was found to be normal. This is of considerable interest, because the patient apparently improved in every way whilst under treatment, and it seems likely that the disease was not due to tuberculous invasion of the gland, but possibly to hæmorrhage, or some other temporary disease.

George C., age 40. I record this case to show that occasionally complete destruction of the adrenal bodies may occur without any of the typical signs arising. Ill 18 months. Noticed that his skin was getting yellow. Had several bilious attacks—one twelve months ago, another ten months ago. Was quite well between these attacks. Upon examination was found to have a dilated stomach, but a normal quantity of hydrochloric acid in the gastric contents. His condition did not suggest suprarenal inadequacy, but, upon death from acute pericarditis, it was found that both his suprarenals were caseous.

Beatrice B., age 24. Illness dates from about two years; the patient had fits apparently of an epileptic nature following a fright. In these fits she struggled, and bit her tongue, but did not relax the sphincters. She has been losing weight and getting weaker, and her friends assert that she is becoming darker. On admission, there is considerable pigment in the axillæ and the upper part of the thighs, neck, and other skin folds. Garter marks and shoulder-strap marks are absent. There is no pigmentation in the mouth nor of the lines of the palms. The scalp is pale. Persistent headaches and vomiting were the chief signs along with occasional fainting. Examination of the discs showed them to be normal. The pulse was of small volume, regular 84 per minute, the blood pressure 108 mm. Hg. Administration of suprarenal gland by the mouth did not appreciably increase the blood pressure. The patient died suddenly, and a tumour in the right frontal lobe was found. The pigmentation in this case was in all probability due to the long-continued ingestion of arsenic. The fits were of an epileptic nature, and bromide along with arsenic had been taken for slightly under two years.

BACKWARD DISPLACEMENTS OF THE UTERUS.

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BACKWARD displacement of the uterus is one of the commonest complaints with which we have to deal in women, and it is by no means one of the easiest to treat. The indications for the use of pessaries, and for operative treatment are much less well defined than for more serious maladies. Many cases are at once relieved by an instrument ; others meet with no relief from the same treatment. The result is a wide difference of opinion as to the importance of displacements and the use of pessaries. Whilst some are inclined to attribute to displacements all the ills to which female flesh is heir, others would neglect the local condition altogether. I suppose, as in all extreme views, the truth lies somewhere midway. It is as much a mistake to neglect the patient's general condition as it is to disregard the local one. Whatever stress we lay on the displacement, the general health should always receive careful consideration. A displacement that, in a healthy woman, might be little more than an inconvenience, in one, who is neurotic or in feeble health, assumes an importance out of all proportion to the physical signs. Another point to bear in mind is that the displacement may be dependent solely on general debility. We find this especially the case in girls and young unmarried women. At all events, its importance as a causative agent, in those who are married and have borne children, is more difficult to establish. For in the latter, pregnancy at once assumes its position as the commonest and most important cause of displacement. Here is a case, in which one is justified in assuming that the general health was at fault. A delicate-looking girl, of eighteen years of age, complained of backache and a "weary-tired feeling." She had been examined before I saw her, and had been fitted first with a ring pessary, and then with a Hodge. I found the uterus lying retroverted, though the body was not very low. There was no retroflexion, nor was there any enlargement or tenderness of the organ. It could be replaced without difficulty and maintained in position by means of a Hodge. She had, in addition, a freely movable right kidney. She was anæmic and delicate-looking.

This was not a congenital displacement, as the uterus could be replaced readily and maintained in position. The presence of the movable kidney showed that there was a tendency to relaxation of fibrous tissues, due, no doubt, to her general ill-health. If I had seen her in the first instance, I think that I should have treated the general condition alone, leaving the retroverted uterus to look after itself. She stated, however, that she had derived some relief from the pessary, and so I replaced it. When I saw her later, the uterus remained anteverted, and she was better as regards symptoms, but I think that the improvement was due rather to the general treatment than to the local.

Treatment by pessaries in girls and young unmarried women should be avoided so far as possible, as it tends to draw too much attention to the pelvic organs, and to cause a lesion there to assume an importance that is out of all proportion to its merits. In such a case, as the foregoing, treatment directed to the improvement of the health of the patient is of vastly more importance than the support of a uterus, the displacement of which has not caused symptoms clearly attributable to the malposition.

Examining patients, as we do in hospital as a matter of routine, we by no means uncommonly find a backward displacement of the uterus without any symptoms that are referable to it. As a rule, these are cases of retroversion, any flexion that exists being slight. When this form of displacement gives rise to symptoms, they are less severe than when marked flexion exists as well, the reason for which I shall mention later. The uterus, being rigid, the cervix is tilted forward, and, by pressure on the bladder, is likely to give rise to frequency of micturition. This and sacral pain, or a dragging pain in the groins, are the symptoms most often complained of. There is no enlargement or tenderness of the body resulting from the displacement, and consequently such symptoms as monthly pain and menorrhagia are absent.

Retroversion is also attended by symptoms when it is associated with prolapse. The cervix is not now tilted forward, but lies low in the axis of the vagina, and the patient complains of a sense of weight and bearing down, relieved as soon as she lies down.

No doubt some of these retroversions are congenital. Some difference of opinion exists as to the frequency of this form. I have recently met with three cases in one week in out-patient practice, but there is no doubt that, as compared with the acquired form, it is relatively infrequent. One must not regard all cases suffering from retroversion, without any symptoms that are referable to the displacement as of congenital origin. The congenitally displaced uterus feels small and ill-developed, although it may be no shorter than normal. The cervix is narrow and conical, and the posterior vaginal wall is short. This form of uterus does not, as a rule, appear to present any bar to pregnancy, although dilatation of the cervix is at times required before conception occurs.

The following is a typical example of the congenital uterus.

A young woman, married three years, complained of monthly pain and sterility. The pain, to commence with, coincided with the onset of the flow, but latterly, it preceded it by some days, and was attended by an increase in the amount lost at the period. On examination, the cervix, which was small and conical, was directed forward, the body was retroverted with slight flexion backwards, and felt small, although its length was not diminished. It could be pushed up, but returned at once to its original position.

The first thing we note in this case is that there are no symptoms dependent on the displacement. Further, that the symptoms complained of are such as we associate more frequently with another form of congenital displacement—sharp antiflexion of the cervix on the body. They are dysmenorrhœa of the spasmodic type and sterility.

It is important to recognise this form, as we shall do no good by inserting a pessary. The uterus cannot be restored to an anteverted position, and no relief from the symptoms complained of would be afforded. These latter require appropriate treatment, such as dilatation or division of the cervix.

It is when we come to deal with retroflexion that we meet with the most marked cases, and get the most characteristic symptoms. Retroversion has little effect upon the uterus; retroflexion, on the other hand, often has a very noticeable effect upon it, and we meet, in these latter cases, with a body that is often tender to touch, bulky, and replaced with difficulty. There are two reasons for this. Owing to the flexion of the body on the cervix, the canal becomes flattened, and there is in consequence a difficulty in the expulsion of the menses and secretions. The retention thus caused sets up endometritis. Another cause of congestion exists in those cases in which the body, descending low in Douglas' pouch, gets nipped by the utero-sacral folds, with the result that the venous return of blood from the uterus is interfered with, either by compression of the veins, or by dragging on the broad ligaments.

In this way we get a bulky congested body lying low in Douglas' pouch, causing sacral pain and pain on defæcation from pressure on the rectum. Owing to this congestion and resulting endometritis, there is increased loss at the periods, and dysmenorrhœa is frequently complained of. Patients, suffering in this way, are frequently constipated, rather, I think, from the pain caused on defæcation than from any actual obstruction. The symptoms, which we find associated with retroflexion, are thus seen to be due much more to the changes set up in the uterus by the displacement than to the displacement itself.

Retroflexion follows frequently on miscarriage or labour, owing to the laxity of the ligaments and the softening of the uterus. After pregnancy, particularly, it is by no means uncommon to find a bulky retroflexed uterus, and it is one of the common causes of bleeding during the puerperium. Involution is interfered with, and the organ, which is soft and not tender to begin with, later undergoes those changes which are spoken of as sub-involution, becoming harder, remaining larger than normal, and associated with the symptoms mentioned above. The condition would be intensified if infection of retained products in the uterus took place.

We should find the same symptoms in those cases in which a uterus, previously the seat of chronic metritis and endometritis, became retroflexed. A uterus, so affected, whilst becoming hard as well as enlarged eventually, is in its earlier stages softened, and this allows of backward flexion. It is not always easy to say, in any given case, whether the enlargement of the body preceded the retroflexion, or was directly due to it, although a careful inquiry into the history of the case will often decide the matter. The question then arises as to which we are to deal with first, the displacement or the endometritis. We may be certain of this, that we shall get no improvement in the condition of the uterus and its lining so long as it remains retroflexed. In any case, then, we should restore the uterus to its normal position. We could either curette the uterus at once, or, if there was not much evidence of change, maintain the organ in an anteverted position, and watch the effect of treatment.

The following case is one of retroflexion, which illustrates some of the symptoms mentioned above.

A young married woman, aged 20, who had had neither children nor miscarriage, complained of constant pain in the lower part of the abdomen and over the sacrum. Her periods were profuse and frequent, lasting sometimes four or five weeks, with a clear interval of a fortnight. Pain was worse at the periods, and intensified by any action that involved straining. She had recently had a yellow discharge. On examination, I found the uterus retroflexed, the body lying low, enlarged, and tender on pressure. An attempt made to replace the uterus manually from the vagina excited such lively pain that it was not persisted in. In these circumstances, it became a question as to what treatment should be adopted. Owing to the tenderness and difficulty in pushing up the body in such a case as this, it is often assumed that the uterus is bound down by adhesions. It much more often happens, I think, that where we assume, in the first instance, the presence of adhesions, the difficulty turns out to be due to the enlargement of the body, which prevents it rising above the sacral promontory, or escaping from between the utero-sacral folds. The tenderness, moreover, when the case is first seen, prevents any serious attempt at manual reposition being carried out. Failing replacement with the fingers, should we use the sound? When the body is congested, and not easily raised, this is a painful procedure, and should not be attempted. The best treatment to adopt, and that followed in this instance, is to order the patient to rest completely for a week, using hot vaginal douches to relieve the congestion, and to attend carefully to the bowels. At the end of the week, it is often found that the uterus is much less tender, and that it can be readily replaced or restored without causing pain by means of the sound.

To assist in reducing congestion, and this is particularly useful where the ovaries are prolapsed as well, we may order pledgets of cotton-wool, soaked in glycerine, to be placed in the vagina over night and withdrawn the next day. In order to facilitate withdrawal, the pledget of wool should have a piece of tape tied to it, and its removal should be followed by a hot douche. If there is much pain, ichthyol is of use in the form of a vaginal suppository of the strength of 10 per cent., or made up with glycerine to the same strength and applied on a cotton-wool pledget.

This should be used two or three times a week. Patients, who are ordered ichthyol, should be warned that its use is likely to be followed by the passage of a membrane, or cast of the vagina. I have known them on several occasions come back alarmed by such an occurrence.

Most cases of backward displacement can be restored manually. The best way to do this is to place the patient in the semi-prone position, and to retract the perineum with two fingers so as to allow air to enter the vagina. With one or two fingers of the right hand, steady pressure is exerted on the fundus through the posterior fornix, and, as soon as the fundus is pushed up out of reach, the cervix should be drawn backwards.

Some cases, however, cannot be replaced in this way, and the question of using the sound arises. Moreover, this may be the only way in which it is possible to detect the presence of adhesions, which are insufficient to cause thickening perceptible to the finger. The chief contra-indication to the use of the sound is the risk of carrying infective material into the uterus, setting up endometritis, and perhaps tubal inflammation. This may be brought about by the use of a dirty sound, or by conveying infection from the vagina or external parts of the patient. This risk may be minimised by ordering douching for a few days beforehand, and carefully attending to the cleansing of the vulval outlet. There is another method, which I employ, especially in hospital out-patient practice, to prevent the introduction of septic material into the uterus on the sound. A Sims' speculum is passed into the vagina, which is well swabbed out with lysol. The region of the external os is then carefully cleansed, and, the anterior vaginal wall being retracted if necessary by an assistant, the sound is passed into the cervical canal without coming into contact with vulva or vagina. The speculum is then withdrawn and the ordinary manœuvre for replacing the uterus proceeded with.

With regard to the pessary employed, the Hodge is the instrument which is found efficacious in the great majority of cases. The form, which I prefer, is the usual pattern with the square lower end, the corners being rounded. The two essentials in the use of the pessary are: that the uterus should be restored first of all, and that the pessary should fit. The upper end should lie in the posterior fornix, the lower end should sit comfortably above the pubic rami, not pressing on them, nor protruding between them. Some modifications have sharply bent and pointed lower ends, but I see no advantage in these patterns, and I think that it is more difficult to keep them in the vagina. Another modification is that of Gervis. The upper end is much wider, and is made concave to receive the fundus. It is employed in those cases, in which the body cannot be restored and maintained in an anteverted position. In these circumstances, the uterus is often intolerant of pressure, and a ring pessary will be found equally serviceable, as a rule, in affording support, and more comfortable. As a general rule, it may be said that a Hodge should not be employed unless the uterus can be restored to its natural position.

How long should a Hodge's pessary be worn? This is a difficult matter on which to make any dogmatic statement. In those cases, in which there seems every possibility of a patient being able to dispense sooner or later with the pessary, I let her wear it for six months to commence with. At the end of that time, if the uterus is in good position, I leave it out, and examine the patient again in a week or two's time to see whether this is maintained.

When found retroflexed after a confinement, and replaced without much delay, one may expect the uterus and ligaments to return soon to their normal condition, and the pessary can be dispensed with. The same thing may be said of those cases, in which the displacement seems attributable to ill-health. The uterus should be restored, and kept in good position, and the patient's health carefully attended to.

Another rarer condition, in which a short course of treatment will usually suffice, is seen in those cases in which the uterus is suddenly displaced. This accident is rare, and some doubt whether it can occur without previous relaxation of the ligaments. The displacement is associated with very severe pain and faintness. The treatment consists in reposition of the uterus, and complete rest in bed for a few days. The following case appears to be an example of this form of accident. A healthy, well-built young woman of 23, unmarried, complained of a continuous gnawing pain in the lower part of her back, which was intensified at the periods, and interfered with active exercise. This dated back to a fall down a flight of steps three years previously. As the result of the fall, she was unconscious for a fortnight, and, on coming to, the pain in the back was noticed for the first time. I found the uterus retroflexed. It was replaced under an anæsthetic, and the patient fitted with a Hodge's pessary. The symptoms in this case dated back very definitely to the fall, and it seems most probable that the displacement of the uterus was brought about by the accident. More obstinate cases are to be found in those, in which the displacement has existed for a long period of time, or in which marked secondary changes have been set up in the uterus. The ligaments have become so stretched, that maintenance of the uterus in a good position for a long time seems to produce no perceptible shortening, and the body, which is often enlarged and tender, falls back again as soon as the pessary is removed. Many of these patients enjoy comfort by the constant use of a pessary. Others are not relieved by these means, and an operation for fixation forwards of the uterus may be called for. Others, again, may demand treatment appropriate rather to chronic metritis than to displacement.

There are cases of displacement which present greater difficulties in treatment, and which cannot be relieved in the same way by means of pessaries. These are cases of retroversion and flexion with adhesions. They often suffer from continuous pain in the lower part of the abdomen and in the sacral region, which is worse at the periods. The periods are increased in frequency and in amount, and reflex nervous disturbances are often present. It is not always easy to say how far the symptoms are due to the displacement, or how far to the surrounding pelvic inflammation. We can judge to some extent by the character and amount of pelvic inflammation. If considerable thickening can be felt in the neighbourhood of the tubes, or if these latter are enlarged and tender, the treatment resolves itself into one of pelvic inflammation. If the inflammation has subsided, and little or nothing is to be felt, but when we find, on attempting to replace the uterus, that it is tethered by adhesions, we may regard the condition as, in the main, due to the displacement. In these cases we cannot hope to cure the displacement by means of pessaries, nor is relief to the symptoms often afforded by their use. Occasionally a patient experiences some relief from the support afforded by a ring or Hodge's pessary, but more often pressure is not tolerated. Amelioration of symptoms is often obtained by means adopted to reduce congestion, such as hot douches, glycerine, and ichthyol ; but the symptoms are liable to return as soon as such measures are left off, unless, as may occasionally happen, we get such absorption of adhesions as to allow of restoration of the uterus. This is only likely to happen in recent cases, in which adhesions have not yet undergone organisation.

Adhesions have been broken down by manipulation of the uterus between the two hands, one acting from the vagina, the other from the abdomen. This, again, is only possible in early cases, and is not free from risk. Hæmorrhage may be set up, or an abscess cavity may be opened. It is not a procedure that one can regard as advisable. Long-standing cases, moreover, where the adhesions are firm, could not be dealt with in this way.

In these cases, we have one of the chief indications for ventral fixation, or some operation having for its object the freeing of adhesions and fixation forwards of the uterus.

If the patient suffers severely or continuously, and no relief is afforded by less severe measures, we are justified in recommending her to undergo an operation, having satisfied ourselves that the displacement is the cause of the symptoms. We ought not to be in too much of a hurry, after an attack of pelvic inflammation, to recommend such a course. We should give plenty of time for exudation to absorb, and confine ourselves to those cases, in which absorption appears to have reached its limit, and in which symptoms, nevertheless, persist.

It is as well to bear in mind the fact that a history of pelvic inflammation is not always readily obtained. It may be so slight as not to have necessitated the patient laying up, or to have been overlooked, as the sequel of a miscarriage or labour.

The following is an example of a retroflexed uterus fixed by adhesions, seen recently amongst hospital out-patients, in which the question of operation arose.

A young married woman gave the history that, five weeks previously, she, being then six weeks pregnant, had bleeding for three days, accompanied by a temperature of 101°. She passed an ovum, and the temperature is said to have subsided. She remained in bed for ten days longer, and from that time she had had constant pain in the left side of the abdomen and back. I found the uterus retroflexed, bulky and tender, and it could not be replaced manually. I ordered hot douches and rest for a week. At the end of that time, manual reposition still failing, I employed the sound. I found that the uterus was undoubtedly fixed by adhesions, although the history of an inflammatory attack was not very clear. The adhesions, moreover, seemed extensive and firm, although I could feel no definite thickening from pelvic inflammation. The question of freeing the uterus and fixing it forwards arose, but, as only six weeks had elapsed since the miscarriage and pyrexial attack, I advised waiting, and ordered hot douches and glycerine pledgets. As the result of treatment, she improved greatly, and although the uterus remained retroflexed and fixed, the symptoms very largely subsided. Should improvement not be maintained, or should changes occur in the uterus and adnexa as the result of the displacement, an operation for the freeing of adhesions and fixing forwards of the organ would be considered.

The cases, which give us the most trouble, are the neurotic ones—patients who suffer from reflex nervous disorders, sickness and dyspepsia, cardiac palpitation, headache, nervousness, pains in the back and abdomen, bladder and other troubles. We may find them associated with all degrees of backward displacement, with or without adhesions. The symptoms seem often out of all proportion to the physical signs, and the condition with which we then have to deal is rather that of a neurotic patient who happens to have a displacement, than that of a patient whose nervous symptoms are due to the displacement. The displacement colours rather than causes the neurotic element. I think that these are the cases which we get sent to us most often for ventral fixation of the uterus. They are comparable, in all respects, with the same class of patient with a movable kidney, and, in fact, we not infrequently find the two lesions in the same woman,—a frequency that must be more than a coincidence, and pointing to a tendency to laxity of fibrous tissues. These patients should be regarded rather from the general than the local standpoint, and it is often an unfortunate thing for them when they discover they have a displacement of the uterus or a movable kidney. After that, they experience no rest until everything possible has been tried. At times, reposition of the uterus affords them relief. Often they cannot bear the pessary, and take it out on one pretext or another, or have it removed almost as soon as it is introduced. Every form of pessary is tried without relief, and, as a last resource, some operation for fixation is undertaken. Here, again, they may meet with relief. It is always an interesting point in neurotic patients, as to how far relief is to be attributed to the moral effect of an operation, how far to the particular operation undertaken. I have seen ovarian dysmenorrhœa relieved by an examination under an anæsthetic, when the patient believed that an operation had been performed. Often ventral fixation is followed by a fresh set of symptoms, and they complain of pain due to the uterus dragging on the abdominal scar. Treatment may be regarded somewhat in the light of an experiment, and the more serious measures should be suggested with caution.

Here is a good example of such a case seen recently.

An unmarried woman, of about 30, who had attended hospital for movable kidney and spinal weakness, came to see me. I found the uterus retroverted. She had been laid up for the last three weeks with sickness and constipation. The pulse was rapid, but there was no cardiac lesion. She suffered from headache, backache, and was undergoing massage for spinal pain and weakness. She wore a belt for movable kidney, although this, on expiration, descended, for half its extent only, below the margin of the ribs. She was a sempstress, lived in one room with her mother, and probably had insufficient nourishment.

I did not think that the retroversion had much to do with the symptoms, and so left it alone. What she wanted was rest and feeding, and I made arrangements for her to go away to a convalescent home.

Before leaving the subject of displacements, I must mention the prolapsed ovary. This is of importance, chiefly from the fact that if it remains low, after reposition of the uterus, it may prevent the use of a pessary. It does not always do so. In the same way as the prolapsed ovary seems to vary in tenderness, so does it tolerate the pressure of a Hodge's pessary in varying degrees. It is assumed sometimes that a prolapsed ovary necessarily becomes congested and enlarged sooner or later. I do not know whether this is so, but I rather doubt it. Tenderness is not a good criterion to go on, nor is apparent enlargement. Ovaries vary very much in size, and normal ones may contain large unruptured follicles. If a pessary cannot be retained, on account of the pain caused by its presence, before an operation is resorted to, we should try first of all local depletion with glycerine, icthyol, and hot douches.

The uterus is replaced, and supported in position by pledgets of cotton-wool placed in the posterior fornix. Rest in bed for a time, with assumption of the prone position as much as possible, will help to keep forward the uterus and ovary. After a course of treatment of this kind we may find that the pessary can be retained without pain.

There is no doubt that a great deal of patience may be required in the management of these cases. If, in spite of such measures, the pessary cannot be borne, and the patient complains habitually of pain, the question of operation will have to be considered.

I have two or three times mentioned the subject of ventral fixation. Under this heading, I include the various operations for the fixation forwards of the uterus. Now all these operations are an evil, and are only to be regarded as of use in dealing with a greater evil.

Although, by their means we bring the uterus forwards, and so place it in a better position, we have interfered with its mobility, and its condition, in consequence, is no more a natural one than it was before. In fact, fixation, by any method, of the uterus should not be resorted to until other measures have had a good trial. In neurotic patients, especially, the operation is liable to be followed by a fresh set of symptoms, namely, dragging pains, due to the pull of the uterus on the abdominal wall, and I have, within the past year, had two patients ask me to release the uterus, as the new pain was worse than the old. It should be remembered, moreover, that it is the patient of nervous type who clamours for this operation, and in whom it is most likely to fail.

A patient, who has undergone the operation, runs an added risk if she becomes pregnant. I do not lay much stress on the liability to miscarriage, as it seems doubtful whether this is greatly increased. It is probably less than would be the case were the uterus left in the retroverted position. It is in the emptying of the uterus that trouble seems most likely to arise. Recently I saw a case which was four months pregnant, and which was threatening miscarriage. The fundus of the uterus was firmly fixed to the abdominal scar, and the cervix was high up behind and out of reach. I anticipated further trouble, but it is interesting to note that the uterus emptied itself without any apparent difficulty.

More serious trouble has been encountered at full term. A number of patients have been submitted to Cæsarian section on account of extreme tilting of the uterus. I have seen the operation performed, on this account, on two occasions.

Rupture of the uterus has also been recorded as occurring in a few instances.

If we allow that these accidents are not common, they are yet sufficiently numerous to make us hesitate before recommending, as a cure of displacement, the more serious measures of treatment by fixation.

The number of cases, in which such an operation is demanded, is very small as compared with those that can be dealt with successfully by means of a pessary. The chief indications for operation would be found in those cases, in which adhesions prevent the uterus being restored, in which a prolapsed ovary interferes with the use of a pessary, or in which the uterus cannot be maintained in position by any form of instrument.

SUMMARY.

1. Many cases of backward displacement are unattended by symptoms, and need no treatment.

2. Some are congenital and have symptoms that are not referable to the displacement, namely, dysmenorrhœa and sterility. These call for a different line of treatment.

3. Where enlargement and tenderness of the uterine body exists, and there is a difficulty in immediate replacement, treatment, with a view to reducing congestion, had best be carried out. The same preparatory treatment would apply to those cases in which the ovaries are prolapsed.

4. When well-marked symptoms of neurosis are present, it is advisable to consider carefully how far the local condition is responsible for them. Treatment in these cases is likely to be somewhat of an experiment.

5. When the uterus is bound down by adhesions, persistence of symptoms, in spite of treatment, will justify an operation for the freeing of adhesions and fixation forward of the uterus.

6. Ventral and other methods of fixation of the uterus are called for in a small minority of cases of backward displacement. Owing to the risks involved in the operation itself, and from subsequent pregnancy, it should be undertaken only when other measures of relief have failed.

MOVABLE SPLEEN.[1]

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Judging from the records scattered through the literature, excessive mobility of the spleen, and dislocation of the spleen from its normal position, are conditions of considerable rarity; but they are still sufficiently often met with to render a remembrance of their possibility most important in abdominal diagnosis. In common with the other solid viscera, which are in contact with the under surface of the diaphragm, the spleen moves up and down with the respiratory contractions of that muscle, and it is consequently necessary to limit the term movable, floating, or wandering spleen, to cases in which the organ has actually slipped, or is capable of slipping, from its usual bed into some other part of the abdomen. The additional term dislocation of the spleen is occasionally used, and is confined to cases in which the spleen, after leaving its normal site, becomes attached by adhesions in some other spot, and again loses its mobility.

The ætiology of the condition has happily not given rise to so many theories, nor to so much discussion, as that which has centred round the more commonly met with movable kidney, and this is probably due to the fact that, as a rule, definite pathological changes can be detected in most cases of movable spleen, when they come under observation either at operation, or at autopsy. The most important of these changes from the ætiological point of view are as follows:—

(1) *Enlargement.*—All writers are agreed in stating that a movable spleen is almost always bigger than normal, but that this is not an invariable condition is proved by the occasional record of cases in which no enlargement is found. Such cases have been put on record by Freudenberg, Martin, and others. In considering enlargement, it is also necessary to recollect that the dislocation itself, by leading to pressure upon, and twisting of, the splenic vessels, may cause great passive engorgement, and that thus the large size may be

[1] A paper read at the Dublin Biological Club.

a secondary and not a primary phenomenon. Still the fact remains that, in most cases, a cause for enlargement has existed before displacement became noticeable.

(2) *Relaxation of the Splenic Ligaments.*—This condition is of course necessarily present in order that displacement may occur at all, and will naturally be favoured by any cause, such as enlargement of the organ, which puts an unusual strain upon them. It has also been suggested that relaxation may result as a developmental defect, while its occurrence, in cases of general splanchnoptosis, is to be expected. In this connection, it may also be mentioned that a movable left kidney is liable to be followed by general loosening of the peritoneum in that neighbourhood, and may thereby come to exert an important causative influence. This last statement is illustrated by the following case, to which I am about to refer, and also by one reported by Grieffenhagen, in which, some time after a nephropexy of the left kidney had been performed, the condition apparently returned, but in operation turned out to be a floating spleen. As a factor in complicating the diagnosis, previous knowledge of the existence of a movable kidney is most important.

(3) *Trauma.*—This probably acts by causing a rupture of the splenic ligaments, and, at the same time, a sudden dislocation of the spleen. Its importance is borne out by many reported instances, but the most striking of these, that I have come across, is a case, reported by Ssawiljew, of a perfectly healthy boy, aged four years, in whom a greatly displaced spleen was found immediately subsequent to a severe fall.

Before leaving the subject of ætiology, it may be as well to refer to the fact that the condition is much more common in women, and is particularly found in those who have a relaxed abdominal wall.

The displaced viscus may be found in almost any part of the abdomen, and has even located itself in such an unlikely spot as the right iliac fossa, but the most common places for it to occupy are the cavity of the true pelvis and the left iliac fossa. Within the pelvis, it may give rise to numerous disturbances, and has simulated, and been frequently mistaken for, tumours, and cysts of the uterus, and its appendages. In the left iliac fossa, it is most likely to be mistaken for a renal tumour, but here also it may resemble an ovarian cyst, or some growth of the mesentery or omentum. Occasionally, even a sense of fluctuation has been detected in the lump, as in a case recorded by Croly in 1896, and in such a case the diagnostic difficulties would be augmented. At first sight, it may seem curious that difficulties in diagnosis should exist at all, as the shape of the spleen is so characteristic, but, when it is remembered that displacement is always accompanied by axial rotation, and also by engorgement, the latter of which tends to alter the shape, the difficulty is easily explained. Again, the normal shape of the spleen is regarded as being largely produced by the pressure and counter-pressure of the adjacent viscera, and I therefore think that we are justified in concluding that some change of shape will result from an alteration of the manner and direction in which these forces are applied. The axial rotation is of such a nature as to bring the diaphragmatic surface downwards and forwards, and consequently to cause the characteristically-shaped borders and edges to be turned away from the examining hand. What relation the spleen maintains, as a rule, to the colon, I have been unable to determine by a glance through the literature, but my own case shows that it may, at any rate, at times slip down posterior to the descending colon. The rotation that occurs may sometimes result in an actual twisting of the pedicle, and, when this has taken place, thrombosis of the splenic veins or artery, atrophy of the spleen, complete necrosis, or even complete separation of the spleen from all attachments, may occur. More usually, however, none of these accidents takes place, and the symptoms are entirely referable to pressure upon neighbouring viscera. Such pressure may prove serious, and even give rise to intestinal obstruction.

The case, which has given rise to the foregoing remarks, was one of a movable spleen, situated in the left iliac fossa, and in which the diagnosis was only made at operation. It, in fact presented us with a typical example of "the astonishment which follows the discovery of these movable spleens in the operating theatres," to which Bland Sutton graphically refers in his interesting paper on this subject. The notes of it are as follows :—L. G., a woman, unmarried, aged 29, first came under my care about 2½ years ago, suffering from serious symptoms of cardiac failure. There was a history of numerous attacks of rheumatic fever, and of long standing cardiac trouble. Some years previously she had had a severe fall from a ladder, which had laid her up for some weeks, but which did not appear to have led to any permanent ill effects. Two months before her admission to the City of Dublin Hospital, her left knee had been excised at another Dublin hospital, for what she stated to be, and for what presumably was, tubercular disease.

Examination, at the time of admission, revealed the presence of double mitral disease, and of adherent pericardium, and, in the abdomen, some slight liver enlargement was noted. In addition, the left kidney was freely movable, and its entire shape and size could be made out with little difficulty, although the abdominal wall was quite well developed. On mentioning in the patient's presence that her kidney was movable, she informed me that a doctor, who had examined her several years previously, had told her the same. The spleen was not palpable, but the area of dulness corresponding with it was rather more extensive than one usually finds. The urine at this time contained albumin, but no pus. Nothing else noteworthy was present; the patient rapidly improved and left hospital after six weeks. During the next couple of years, she was re-admitted on three different occasions. On the first two of these, her symptoms did not differ from those referred to above, but, on the third occasion, she complained somewhat of pain in the left side of the abdomen, and on palpating here a distinct lump could be felt, which moved freely up and down, and was exquisitely tender on pressure. The tumour felt about twice the size of a normal kidney, but it rapidly decreased in volume, and nothing at all could be felt at the time when the patient left hospital, two months subsequent to her admission. I did not see her again for six months, when she was again admitted, suffering from severe cardiac asthma and complaining very much of her left side. Examination revealed the presence of a tumour in the left lumbar and left iliac regions, and of a much greater size than it had been on the previous occasion. The lower margin of it could be distinctly felt to be rounded, and an obscure sense of fluctuation was obtained over it. The upper margin disappeared under the costal arch, and could not be felt. On palpating the growth, it was found to move up and down slightly, while percussion revealed the presence of intestine anterior to it, and yielded a dull note at the side, from about the line of the anterior axillary fold back to the spine. It was still intensely tender to touch, and severe paroxysms of pain, lasting often for over an hour, were experienced in the region once or twice daily. The urine was still albuminous, but free from pus, and the only other symptom present was great frequency of micturition, but without bladder pain. The temperature was normal, and there was no leucocytosis. The diagnosis, at which I arrived, was that of hydronephrosis secondary to movable kidney, and, as I thought that surgical intervention might become necessary, I asked my colleague, Mr. Stoney, to see the case with me. He concurred in the diagnosis, and, at my request, made a cystoscopic examination. This was necessarily unsatisfactory, as it was thought inadvisable to give an anæsthetic, and the patient's condition made her extremely sensitive, but, so far as it went, it was in favour of the diagnosis otherwise arrived at, as no cystitis was found to account for the frequency of micturition, and the quantity of urine obtained from the left kidney by the segregation method was less than from the right. We, however, decided that, having regard to the condition of the heart, it was better not to operate, unless signs of suppuration within the sac occurred, and this determination seemed justified by the subsequent course of the case, as, within three days, the tumour noticeably diminished in size, and finally almost completely disappeared, along with a disappearance of the distressing symptoms. This last event was regarded as confirming the diagnosis arrived at, even though no great increase in the urine passed took place, owing, it was supposed, to the gradual nature of the subsidence.

The patient was soon after admitted into the Incurable Hospital, and I thought that I had seen the last of her, but this was not the case, for, early in May of last year, she returned to me saying she was worse than ever, and referring all her troubles to the abdomen. The tumour, which I have already described, was again present, but rather lower down than before, reaching now almost to Poupart's ligament, and, with a little difficulty, the hand could be pressed backwards between its upper border and the ribs. Both upper and lower borders felt rounded to the touch. It was fairly movable in a vertical direction, but not at all horizontally, and once more was dull at the side and the back, but resonant in front. The differential diagnosis between renal, splenic, and other tumours was discussed at length, and the original diagnosis of hydro- or pyo-nephrosis was adhered to, but with a strong suspicion now that a pyo-nephrosis was present. The reasons for suspecting pus on this occasion were as follows:—(1) The patient's temperature, which was above normal on admission, became intermittent and septic in type soon after, ranging from 97° F. to 103° F. within twenty-four hours. (2) The patient began to suffer from daily rigors, many of them of a severe type. (3) There was now a considerable amount of pus in the urine (catheter specimen) and no tubercle bacilli were present. The urine was acid in reaction. (4) There was much sweating at night, and the whole aspect of the patient was indicative of combined pain and toxæmia. (5) There was apparently no other condition present which could explain these symptoms, unless malignant endocarditis had become superadded to the old chronic inflammation. The only point in fact against the presence of pus was the constant absence of any leucocytosis, or even relative increase in number of neutrophile leucocytes. It was not, however, felt that this last was a sufficient contra-indication to operation, more especially as the patient herself was clamorous for something to be done to relieve her, and accordingly it was decided to explore the region from the back, and to drain the supposed cyst. Mr. Stoney operated on May 16, and on cutting down found the kidney in its normal place, while the tumour lay in front of and below it, and turned out to be a displaced movable and enlarged spleen, axially rotated in the manner already referred to, and with the colon lying anterior to it. The patient was not sufficiently strong to warrant any attempt to deal with the spleen, and accordingly the wound was closed. A good recovery was made, but unfortunately without improvement in the pain complained of, and the patient ultimately left the City of Dublin Hospital to return to the Incurables, refusing any further cystoscopic examination before her departure. Before leaving, the tumour was found to be displaced forwards a little, doubtless as a result of the operative manipulations.

In thinking over the case, the most difficult symptom, that I had to account for, was the extraordinary variation in size which took place in the tumour, and actually under my own observation, and it was not until I discovered Mr. Bland Sutton's paper that I was able to understand it. In this paper, the author states that he has seen an engorged spleen shrink to one-third its bulk during the course of a laparotomy, and also refers to a spleen which, during life, extended from the floor of the pelvis to midway between the umbilicus and ensiform cartilage, and which, on being excised, contracted, in fifteen minutes, to a length of six inches, and, in six hours, to about normal size. Doubtless a twisting and untwisting of the pedicle could allow similar changes to occur, and, moreover, when the organ got smaller, it would more easily return to its normal place. The resemblance thus given to an intermittent hydronephrosis is obvious, and in consequence deserves more attention than has hitherto been paid to it. The origin of the pus, and the cause of the intermittent temperature and of the rigors were not cleared up by the operation, and the only explanation that I can offer is that a pyelitis was present, and was responsible for the pus and toxæmic phenomena without, however, causing any mechanical dilatation of the pelvis of the ureter. The lessened flow from the left kidney as compared with the right was, I presume, due to pressure upon the ureter by the enlarged and displaced spleen.

Looking over reported cases ot wandering spleen that resembled hydronephrosis, I can find only one or two in which marked variation in size is referred to, and perhaps the one most closely resembling the case described above is that reported by Dr. Lucy in the *British Medical Journal* for July 14, 1906. Cases of this nature are, however, infrequent, as compared with those in which a pelvic tumour is simulated, for, during the last ten years, not more than four or five reports in all are to be found.

As regards the ætiology in this case, I think that the combined influence of the movable kidney and of cardiac congestion must be held responsible. That it was the kidney which was to be felt slipping up and down, when the patient first came under notice, I have not the least doubt, and the way in which this would lead to mobility of the spleen, is easily conceivable from an anatomical point of view. The pain, which is often present in these cases, is presumably the result of distension of the peritoneal covering of the viscus, and of dragging upon the various ligaments.

Into the question of the treatment of movable spleen, I need not enter further than to say that opinion seems pretty evenly divided between splenectomy and splenopexy. The former has most frequently been practised, and has the advantage of yielding a permanent cure. In the case of the latter method, recurrence has been more than once recorded. As already stated, neither treatment was justifiable in the present instance, and the patient, on recovering from the operation, refused any further treatment for the pyæmia, or any further examination.

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NOTES ON TWO CASES OF LEPROSY AFFECTING THE EYES.

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[With Plates V. and VI.]

The increasing intercommunication between Eastern and Western civilisation, between European, Oriental, and Aboriginal tribes, has led to our occasionally seeing diseases endemic in remote lands but rare in England. Leprosy is one of these. The number of lepers in England to-day is small, and consequently, when the disease presents itself to the unsuspecting medical man, it is very often unrecognised. It is important, therefore, that our attention should occasionally be drawn to its manifestations, and, for that reason, I record two cases recently under my care.

Leprosy is a specific disease, the result of infection by the Bacillus Lepra. This bacillus was discovered by Hansen of Bergen in 1871, and is similar to the Tubercle Bacillus. Leprosy occurs independently of any geographical or climatic conditions, but, at the present time, seems to affect the Latin more than the Teutonic races, although the whole Aryan race has been liable to it at one time or another.

In its dissemination from one person to another, it is similar to tubercle, although the evidence for its transmission by inoculation is inconclusive. It manifests itself usually by—

(*a*) A tubercular form, in which nodules form in the skin at the site previously occupied by erythematous hyperæsthetic patches ; or

(*b*) An anæsthetic variety, which begins with hyperæsthesia followed by anæsthesia and atrophy of the skin, muscles, etc. ; or

(*c*) A mixed variety, in which, as its name implies, both forms (*a* and *b*) are present.

My cases are of the mixed variety, and both patients have suffered from leprosy for some years.

With regard to treatment, chaulmoogra oil is generally considered to have the greatest beneficial effect on leprosy, but even its most ardent supporters are often very disappointed in the results obtained with it. Quite recently (*Lancet,* April 13, 1907) we have received an account of cases of leprosy, which have been cured by the use of an antitoxine; but it is too early yet to be able to form an opinion as to the merits of the new treatment. Chaulmoogra oil is obtained from a plant native to Burmah, called Taraktogenos Kurzii, and is used in 1—25 doses.

Segregation, improved hygienic and dietetic conditions have doubtless tended to lessen this awful scourge, but many points yet remain too obscure for us to lay down any dogmatic statement as to the reason why it remains endemic in some places, and is on the increase in others.

Case I.—A. B., male, was born in 1873, in Barbadoes. He remained quite healthy until 1894. The following year he came to England, where he has since remained. There is no history of leprosy in his family. In 1894, he noticed a sensation of smoothness at his finger trips when touching rough surfaces, and his hands became somewhat swollen; a little later nodules developed in the skin of his face, and, a few months afterwards, he noticed a discharge from his nose. Definite anæsthesia of the hands, arms, and feet gradually developed, together with wasting of the muscles.

In 1901, the right eye became infected; first the conjunctiva, and two years later the iris. About the same time nodules appeared in the skin of the forehead. The disease, which is of the mixed variety, has gradually progressed; he has numerous leprous ulcers, and there are many pigmented maculæ, in the skin of the arms and legs.

The patient is a tall, well-proportioned man, with dark brown skin, black hair, and a thick black moustache, a portion of which has been destroyed by the disease. He presents the typical "facies leontina." His voice is soft, and his manner and speech slow and deliberate. He is a man of considerable education, having been a law student and university coach. His eyes are overshadowed by the thickened skin of the brow, so that, at the first glance, the ocular condition is not noticeable. His hands feel soft, thin, and powerless, and on inspection the thenar and hypothenar eminences are very much wasted, the "clawed" condition being well marked. He walks slowly, is easily tired, and perspires freely.

PLATE V.

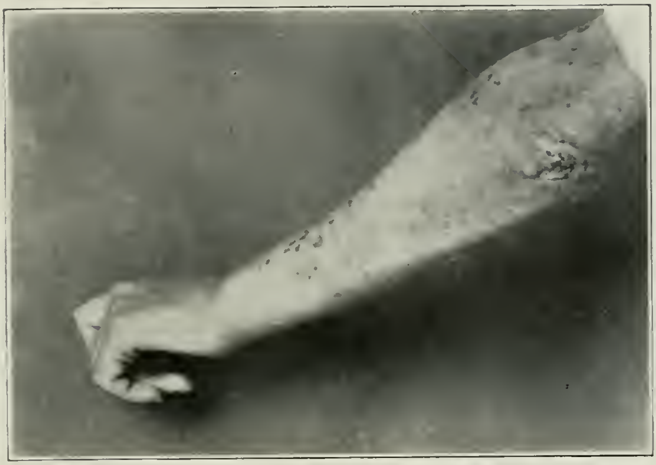

Fig 1.—*Case I. A. B. Left arm showing maculæ and nodules of the skin.*

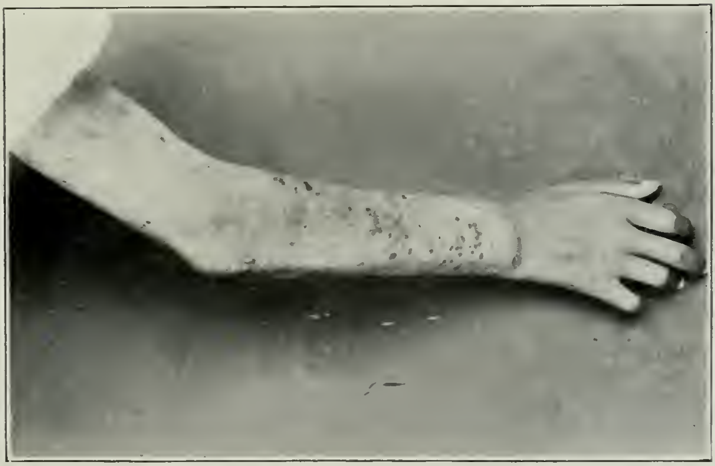

Fig. 2.—*Case I. A. B. Right arm and hand. Note the wasting of the muscles and the "clawed" condition.*

PLATE VI.

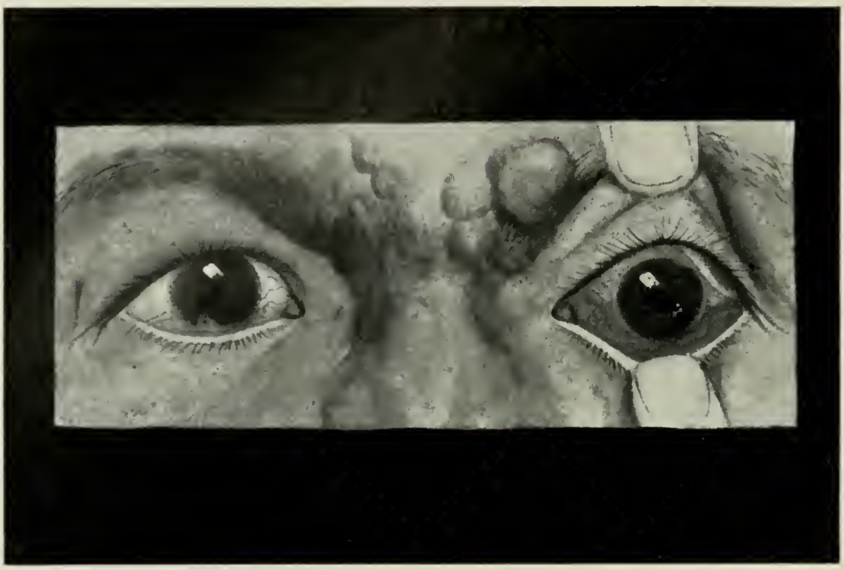

Fig. 3.—*Case I. A. B., æt.* 33, *male. Note the opacity of the corneæ; the irregular pupil; the pigmented deposit in the pupil; the ivory-like sclerotic of the right eye; also the nodules in the skin of the brow and the three calcareous nodules on the left iris. (The redness and injection of the conjunctiva of the left eye were due to a sub-conjunctival injection made the previous day.)*

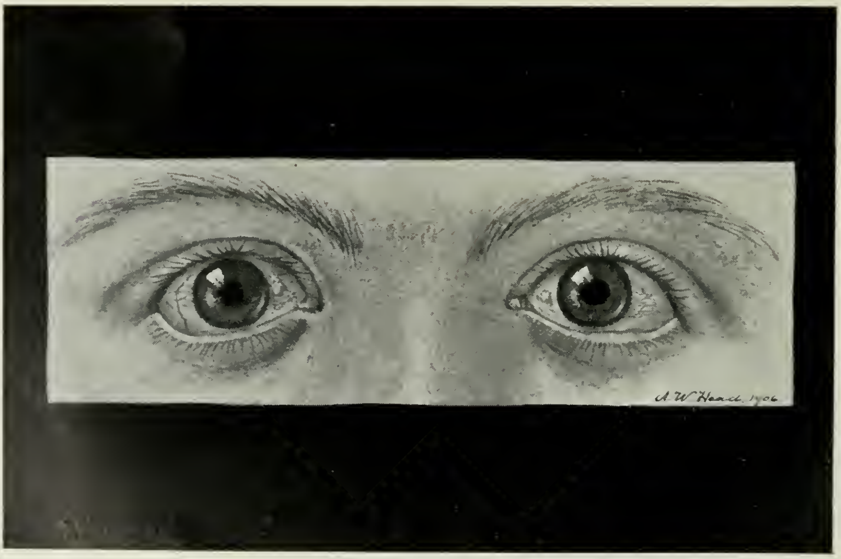

Fig. 4.—*Case II. C. D., æt.* 24, *female. Note the sagging of the right lower lid; the nodules in the left lower lid; the enlarged vessels over the sclerotic, and the inequality of the pupils.*

OCULAR CONDITION.

Right Eye.—This was the eye first attacked. His vision is J. 20 at 1 foot, and is not improved with any lens. The field of vision is very much contracted, more so above than below. The eyelids can be completely closed. The epiphora, which is occasionally present, is due to increased secretion during acute attacks of inflammation. The conjunctiva is injected, the larger vessels being very obvious as they course over the ivory-like sclerotic. The cornea has extensive diffused marginal opacities, occupying the lower third. The opacity is interstitial, the corneal epithelium being quite smooth, the iris is flat and thickened, and its stroma indistinct. The pupillary opening is irregular, and has deposits of pigmented lymph within it. The tension is -2. There is some slight deposit on the posterior surface of the cornea. No details of the fundus can be seen, the red reflex being a uniform dark red. The pupil refuses to dilate with atropine, although it has been applied over a long period, and the sight in this eye has been useless for over 12 months.

Left Eye.—Visual acuity in the left eye $= \frac{6}{12}$; it is not improved with glasses. The field of vision is only slightly contracted, and the tension is normal. The lids are not affected. The conjunctiva is more injected and reddened than on the right side. The cornea has some nebulous opacities at its margin, and the pupil is pear-shaped, the iris being flattened and adherent to the anterior part of the lens. At the lower and outer quadrant of the pupil three small white nodules are seen in the iris, looking like calcareous deposits. The red reflex is bright, the disc can be seen but indistinctly, owing to a slight vitreous haze; its margins are regular, and the fundus, so far as can be seen, shows no gross organic change.

The patient has had periodic attacks of pain in the right eye, the onset of the attacks being associated with exposure to bright light or prolonged effort, such as reading, etc., the eye becoming red and watering, with considerable super-orbital neuralgia. The attacks last from 24 to 36 hours, and are followed by dull aching pain; these symptoms recur at intervals, varying from one to two weeks. The patient's left eye seldom troubles him in the way of pain or watering, but the vision is slowly failing.

Treatment.—The patient, who first consulted me in July, 1906, was admitted into Guy's Hospital, and an iridectomy performed on the right eye. The wound healed very satisfactorily, and although, owing to the firm adhesions of the iris to the lens capsule, the coloboma was a little irregular, yet the patient was able to see rather better afterwards, and he runs little risk of losing his sight now, as a result of an occlusion of the pupil. Sub-conjunctival injections of normal saline solution were used in order to flush the lymphatic circulation, about 20 mm. being injected at a time. A 1 per cent. solution of dionine was employed also, and instilled into the conjunctival sac three times a day. Under this treatment, the right eye ceased to water, and the attacks of pain and inflammation became less severe and less frequent; the vision improved slightly. Sub-conjunctival injections and dionine solution were used also for the left eye with marked success, his vision improving to $\frac{6}{6}$. This improvement, however, has not been continuous; it dropped recently to $\frac{6}{12}$ during a period when he was in hospital for the purpose of having ulcers and tubercles scraped. I hope, however, that he will regain what has been lost when his general condition improves.

I endeavoured to find out whether it was possible to apply chaulmoogra oil, or any of its active principles, directly to the eye, but unfortunately the oil, and the acids obtained therefrom, are insoluble in water. Messrs. Burroughs Wellcome, to whom I referred, state that they have obtained from chaulmoogra oil a new chrystalline acid, to which the name chaulmoogra acid has been given, but it does not appear to be practicable to introduce this into the eye as it would cause so much irritation. Atropine was used for about one month, but did not appear to produce any marked effect on the symptoms of pain and irritation. A weak Hyd. Ox. Flav. ointment was used, and caused irritation. I think, however, that the opacity of the cornea in the left eye became less marked during its use. The patient is taking chaulmoogra oil internally.

Case II.—C. D., female, aged 24. Was born in London, but was taken to South Africa when a baby in arms; she remained there until she was 17. Since that time, she has made many journeys to and from South Africa, where she has travelled much. When aged 18, she noticed on her left arm two marks, which her friends thought were due to ringworm, and treated accordingly, with unsatisfactory results. About the same time, she noticed some swelling of the feet. Shortly after this, she came under the care of Dr. Abraham, who at once recognised the condition.

Following on the other symptoms came a gradual and partial anæsthesia of the hands, with wasting of the muscles of the arm and forearm; the "clawed" condition was present in both hands. Her face has on it numerous nodules, and there is one large nodule below the right ear. The patient has some nasal obstruction, and suffers from frequent attacks of slight epistaxis.

Her voice was at one time affected, as she had aphonia for three months, but it has since recovered. In the early morning she has attacks of coughing.

The most noticeable feature in the patient's face, at first glance, is the ectropion of the right lower lid and lagophthalmos, so that when she blinks, the eyeball rolls upwards, and exposes a large part of the sclerotic, which is uncovered by the lids. The skin of the neck and shoulders is free from any sign of the disease; the patient is able to wear evening dress. Her hands are thin, and the muscles very much wasted, especially those of the thenar and hypothenar eminences, but there is sufficient strength in the hands, wrists, and forearms for the patient to play the piano.

Three years ago, that is in 1904, the patient's eyes began to trouble her; she noticed a veil coming over the vision of the right eye, which she described as being like the map of Africa; the eye also began to water. Now her lower lid droops, and the eye remains open when she is asleep. The pupil of the right eye does not vary in size, and the patient notices that, at times, the left pupil is smaller and, at times, that it is larger than the right; she also suffers from pain in the eye. The vision is $\frac{6}{24}$, not improved. The vessels in the conjunctiva are large and conspicuous; at the outer and lower quadrant there is a raised mass extending to the cornea scleral margin—the patch resembles a patch of episcleritis. Circumcorneal injection is present. At the upper part of the cornea is a deep-seated opacity, which is filmy and nebulous, and the posterior surface of the cornea is covered with dots (*Keratitis punctata*). The pupil does not react to light or atropine.

Left Eye.—In the left eye, the vision is $\frac{6}{6}$, and there is + ·75 cylinder vertical of astigmatism. The pupil dilates regularly to light and atropine. There is some slight conjunctival injection, and a few large turbid-looking veins can be seen. The lower lid sags slightly, but can be closed, and is closed during sleep. A slight thickening of the margin is due to some infiltration of the lower lid; the upper $\frac{1}{8}$ of the cornea has an interstitial haze in it; there is no keratitis punctata. The optic disc is healthy, and can be clearly seen, and there is no pathological change in the fundus. I advised a domino made of silk, with an opening for the left eye only, to be worn during sleep, but the patient found a difficulty in getting it made, and subsequently preferred to use a light silk gauze scarf.

A solution of dionine, 1 per cent., and a weak ointment of Hyd. Ox. Flav. were ordered. The watering and irritability of the eye became much less under this treatment, but the patient will probably submit later on to having the interpalpable fissure on the right side reduced, by stitching the outer canthus, and so diminishing the lagophthalmos and the ectropion.

Chaulmoogra oil is being used by both these patients, and although I have watched the ocular condition for a comparatively short time, still it is quite evident that many of the more distressing symptoms complained of by both patients have been relieved.

In the former case, the vision of the patient's left eye has been considerably improved, and he is now able to read with comfort for long periods, and so relieve the tedium of his enforced idleness. The pain is much less acute, the attacks much less frequent. I think that dionine has been distinctly useful in relieving the pain in both instances.

These cases are examples of chronic inflammation of the uveal tract, similar to the condition met with in inherited syphilis, producing opacities in the cornea, lens, and vitreous, and atrophy of the ciliary body with consequent softening and shrinking of the eyeballs. The course of the disease is, however, much more prolonged.

Grossmann states[1] "that in the lepra tuberosa the eyes become specifically infected in *all* cases, provided the patient lives long enough, whereas in lepra anæsthetica the eyes may remain unaffected if the nerves supplying the adnexa of the eye remain free. The nodular form of leprosy generally affects the adnexa first, supercilia and lids, and attacks the eye itself later, though the eye may be affected while no nodular infiltration of the lids is present."

Dr. Sinclair Black[2] comes to the conclusion that all the evidence tends to show that the disease begins as a small collection of round cells under the mucosa of some part of the nasal cavity. It is interesting in this connection to notice that both these patients had nasal symptoms early in the disease, and the first patient told me that he consulted various surgeons about the condition of his nose, and was struck by the hopeless view which they took of his trouble. This was probably due to the extent to which the disease was already present.

The statement that Lepra Bacilli have been found in the Common Bug, Cimex Lectularius, opens out a new field for investigation. (*Vide Nature,* August 9, 1906.)

I am indebted to Dr. Phineas Abraham for drawing my attention to these two cases of leprosy, and for permission to publish my notes.

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[1] *B.M.J.*, January 6, 1906.

[2] *Lancet,* October 20, 1906.

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FONS ET ORIGO MALI MARIS:

OR,

AN INQUIRY INTO THE CAUSE OF SEA SICKNESS.

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VOMITING is produced by direct stimulation of the medulla, or by reflex irritation through one or more sensory nerves. Sea sickness is essentially a condition brought about by the motion of a ship, and, as the reflex causes of vomiting are so numerous, one must eliminate from the consideration of the cause of sea sickness all those which have no reference to motion.

On referring to the articles on sea sickness in standard works, we find some of the following descriptions of its pathology :—"The cause is quite obscure. It may be that the epigastric region is the seat of an equilibrative centre. . . But it is more likely, that the epigastric sensations of discomfort are secondary to a disturbance in the cerebrum or medulla."—"Sea Sickness," *Encyclopædia Medica*, Vol. 2.

"In regard to the pathology, some look upon it as gastric irritation, due to movements of the stomach on board ship, others as of central origin, due to reflex impressions from the eyes, or to the disturbance of the circulation in the vomiting centre in the medulla. In all probability, these views are all correct, for sea sickness is of mixed origin."—*The Action of Medicines*, Lauder Brunton.

In *Quain's Dictionary of Medicine*, 1902, the pathology of sea sickness is thus described :—"The equilibrium apparatus appears to be the essential seat of the disorder. Rosenbach points out, that a degree of tolerance of certain changes in equilibrium is established in each individual; that this varies in different cases, and that any marked excess of movement, to which each individual mechanism is adapted, will give rise to the phenomena of sea sickness."

According to his view "the semicircular canals play no important part, but in the epigastrium lies a mechanism which works as an apparatus directing movement and balance, and giving information to the brain concerning the position of the body, the direction of oscillation, and the acceleration of individual parts."

There is a unanimity of opinion that the disturbance is of central origin, but a diversity of opinion as to the origin of the stimulus.

The view that vision plays any important part, is, I think, untenable.

Dr. Metcalf Sharpe favours the view that the stimulus is supplied through the special sense organ of vision, and supports this theory by the experimental treatment of paralysing the accommodation of one eye. But in estimating the value of any so-called cure, or treatment, allowance must be made for individual idiosyncrasy, and respective ability to become used to changes of surroundings. This applies to no complaint more strongly than to that of sea sickness, where the power of recuperation, and the ability to become slowly or quickly accustomed to the motion of the vessel, vary so much in different individuals. Treatment that will prevent or cure sea sickness in one person has no effect on another. There are captains who have been travelling for years, and yet are sea sick on a rough passage ; and there are others who, on every voyage, are ill at starting and recover immediately.

The connection between vision and balancing power is fairly obvious, but I do not think that it plays any great part in the production of this form of vomiting. Sometimes dizziness or giddiness is produced through vision, but the ataxia of tabes dorsalis is more pronounced with the eyes closed, and when the patient attempts to walk in the dark.

Giddiness is a very serious reality to climbers, builders, architects, and others, who have to ascend to great heights, hence the expression "giddy heights." But it is to the point to note, that these never complain of nausea or vomiting, except in the case of mountaineers. Mountain sickness may, however, be referable to other causes, such as atmospheric pressure, and not directly to vision.

Blindness is no panacea against sea sickness.

"Sixty per cent. of the pupils of the Liverpool School for the Blind suffer from the complaint, and another twenty per cent. are uncomfortable when taking a sea trip from Liverpool if the sea is at all rough" is the report of the superintendent, a percentage equal to, if not greater than, that found in sighted people. Sometimes, those, who suffer much from the complaint, are advised to lie down immediately on going on board, and close their eyes. But closing the eyes, and blotting out the sight of the dancing waves, and the uncertain rise and fall of the vessel's bows will not avert the catastrophe. Nevertheless, we have well authenticated cases of curiously constituted people, who are sea sick before going on board, and in whom even looking at the waves from the sea shore will induce the condition. Probably, in such cases, a giddiness is produced associated in their minds with the premonitory symptoms of sea sickness, and in highly neurotic persons, it is possible that vomiting may occur as a psychical rather than a physical act. That is one condition known as Menière's disease, in which four of the symptoms occurring in sea sickness, *i.e.*, Headache, Tinnitus, Vertigo, and Vomiting, are allied to a fifth, *i.e.*, Deafness. It is also said that, when the deafness becomes absolute, the other distressing symptoms are very much alleviated, or else entirely disappear. It is a curious, perhaps analogous, fact, that there is one class of sorely afflicted people who are never sea sick. I refer to deaf mutes. By deaf mutes I mean those who have been born deaf, or who have lost their hearing at a very early age. I have not been able to discover at what age the onset of deafness fails to bring with it immunity from sea sickness, but those who become deaf late in life still suffer from the complaint. I do know of one gentleman who lost his hearing at the age of twenty, and was never sea sick after.

A party of twenty-five deaf American gentlemen crossed the Atlantic, in 1889, to attend the Paris Congress of Deaf Mutes. It was a very rough voyage, and every passenger was ill except the deaf mutes, who had all the tables in the dining saloon to themselves. A deaf lady was a passenger by the same boat, and she and the captain had one table to themselves throughout the voyage.

Another idiosyncrasy, peculiar to deaf mutes, is that they do not experience that sensation in the stomach once described as "a momentary displacement of the viscera" to which most of us are liable on descending in a lift, or in swinging. Nor have the deaf mutes, to whom I have spoken, experienced nausea, or sickness when climbing, or looking down precipices.

The connection between sea-sickness and the organ of hearing does not at first sight seem very obvious, but the simple act of syringing the ear produces, in some people, all the symptoms of *mal de mer*. A relative of mine says that he can produce the sensations of being at sea in all their horror by the mere act of syringing his own ear. He turns faint and giddy, vomits, and is obliged to lie down for several hours in order to prevent the recurrence of the vomiting.

The following case is also of interest with reference to the connection between the auditory organ and motion :—

A young lady, when 17 years old, had a severe attack of scarlet fever and diphtheria. The glands in her neck suppurated, and she entirely lost the hearing of one ear. She is now married and has one child. She is unable to ride a bicycle, or to walk in the dark ; indeed, she is very uncertain of her walking even in daylight. But her eyesight is normal, reacting to light and accommodation, and there is no astigmatism. From being a very bad sailor, she is now quite happy at sea, and never suffers from sea sickness, although her hearing is not entirely destroyed. In reviewing the various causes of sea sickness put forward by different authorities, I come to the conclusion that :—

(*a*) Strictly speaking, the vomiting is not due to the unusual impression of vision, as it occurs in some people on land ; it occurs even when the eyes are closed, and the blind suffer as much as, if not more than, sighted people.

(*b*) It is not due to smell. Any bad or unpleasant odour may cause vomiting. This cause is common to people on land or sea, in fact, to any or all, including deaf mutes, who have sensitive nasal organs.

(*c*) It is not due to momentary displacement of viscera which seems to occur in swinging, or in descending in a lift. The sensation is present whether the eyes are open or closed, but it does not occur in deaf mutes.

(*d*) There is some mechanism in the auditory organ, possibly the system of semicircular canals, which is directly affected by the oscillations of a vessel at sea, and which acts as a stimulus to the vomiting centre.

With regard to the nature of the movement, it may be pointed out that it is one of sudden descent, as any one may prove for himself by trying a few experiments in a lift. I have certainly noticed a peculiar sensation in my ears, synchronous with the sensation in the epigastrium, on the sudden downward movement of a lift, and experienced no sensations on the upward movement. It is conceivable that these sudden and unexpected movements may take the endolymph in the semicircular canals, so to speak, unawares, and create a condensation or rarefaction, or both alternately, in one part or another of the labyrinth, thereby altering the pressure on the nerve endings, and thus causing a direct stimulus to vomit.

The routine treatment adopted for combating sea sickness is compatible with this theory, as it mainly consists in lowering the sensibility, or conductivity of the afferent nerves, or in numbing the vomiting centre by the action of such drugs as potassium bromide, chloral, or morphine.

If this theory is not altogether convincing with regard to the origin of sea sickness, it may possibly induce anatomists and pathologists to enquire more closely into the exact nature of the lesion that occurs in the auditory organs of deaf mutes; although there are obvious difficulties in the way of procuring subjects for examination and dissection.

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A REVIEW OF RECENT LITERATURE ON HERNIA.

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ÆTIOLOGY OF HERNIA.

It seems extraordinary that a definite decision has not yet been arrived at as to the origin of the hernial sac. The time-honoured division of all hernial sacs into congenital and acquired has of late years been much questioned, and a controversy on this subject has lately appeared in the medical journals.

Hamilton Russell, of Melbourne, has contributed papers on this subject during the last few years, and Murray, Deanesly, and others have expressed dogmatic views on the same question.

That the subject is not a merely theoretical one is evident, as the *rationale* of the radical treatment of hernia is based on the true conception of the origin of the hernial sac. It has for long been considered that there are two distinct classes of hernia, the one congenital, depending entirely on the pre-existence of a peritoneal protrusion, the other acquired, due to some weakness in the abdominal parietes which allows such protrusion to occur. The difficulty hitherto has been to decide, in certain cases, which are congenital and which are acquired. It is generally impossible to distinguish at the operation an acquired from a congenital sac, and it is obviously futile to attempt to fix an age limit after which a congenital hernia does not occur. The theory that all herniæ are truly congenital is an attractive one, and one most difficult to controvert by arguments. If every case of hernia is truly congenital, a radical cure should result after the complete removal of the unnecessary protrusion of peritoneum. If, however, one admits that other factors, such as a too patent abdominal ring, weak musculature, etc., are responsible, then a more elaborate technique to remedy the defect becomes necessary.

THE SACCULAR THEORY OF HERNIA AND RADICAL CURE.

Hamilton Russell, of Melbourne (*Lancet*, November 3, 1906), is an ardent advocate of the so-called "saccular" theory of hernia as opposed to the "acquired" form. He points out that the defects of the present point of view are responsible for :—

(1) A double ætiology, viz., congenital and acquired.

(2) A multiplicity of operations for radical cure.

(3) The results of operation uncertain, due to uncertain principles.

(4) A facility in explaining that recurrence after operation is due to inherent weakness of the muscular structures in the inguinal region.

(5) Misuse of the truss, especially in children.

On the other hand, the results of the saccular theory are :—

(1) A single ætiology with a fixed principle of treatment.

(2) A single operation, viz., removal of the sac.

(3) The certainty of a good result, provided a faultless operation.

(4) Recurrences due to a defect in operative technique.

(5) Abolition of the treatment by trusses, except where contra-indicated, or operation is declined.

He classifies abdominal herniæ as follows :—

(1) Saccular, this includes all cases of ordinary hernia.

(2) Traumatic, that is, after injuries, including surgical operations.

(3) Congenital, due to congenital imperfections of the abdominal wall in the middle line or lumbar region.

SACCULAR HERNIA.

This includes all abdominal herniæ, which result from the descent of some portion of the abdominal viscera into the sac. The sac is a peritoneal diverticulum of developmental origin, and can be traced back to an early period of embryonic life. It has close relationship to vessels passing from the abdomen to the limbs, and is due to an accidental involvement of a portion of the wall of the primitive pleuro-peritoneal cavity in the developing limb.

The vast majority of all inguinal herniæ are funicular, that is, due to the non-obliteration of the funicular process.

Direct and indirect inguinal herniæ are for the most part funicular in origin. There are very few examples of a non-funicular direct hernia. The author further recognises that there are three sub-classes of funicular hernia depending on :—

(*a*) Variability in obliteration of the funicular process.

(*b*) Variation due to primary anatomical causes of developmental origin.

(*c*) So-called viscero-saccular herniæ, due to alterations in the funicular process, owing to traction by some viscus in its neighbourhood.

Variability in obliteration of the funicular process gives rise to two forms of hernia, viz., total funicular hernia, and partial funicular hernia. Russell thinks that all these varieties mentioned are due to the presence of the gubernaculum testis, and traction by neighbouring structures. The varieties of interstitial hernia can be logically explained on this hypothesis, and their frequent association with the imperfectly descended testis is considered to be a concomitance, and not a result of the same. In describing the radical cure of inguinal hernia, the author lays especial emphasis that attention should be directed to the peritoneo-fascial, and not to the muscular layers. He describes a special form of suture, which includes and draws together the peritoneum and fascia at, and in the neighbourhood of, the internal ring. The muscular layer is not sutured. The same remarks obtain in the treatment of femoral hernia. The author has operated on 89 cases ; of these 63 have been traced, and the after-results noted. Recurrence occurred in 3 cases only. A further paper, dealing with this subject, appears in the *Annals of Surgery*, May 1906, entitled "Congenital tumours of the groin and their relationship to hernial sacs." Two cases of cystic tumours, occurring in the groin, are described, apparently arising in the groin in connection with a peritoneal diverticulum. They occurred in boys aged 5 and 6 years respectively. Russell considers that they form a strong argument in favour of a congenital origin of the femoral hernial sac. He quotes from two of his own papers published in the *Lancet*, May 21, 1902, and March 12, 1904. In the latter paper, the suggestion is made that a pouch of peritoneum may be included in the limb bud at the second month, and that this may become obliterated in turn. The various positions, occupied by a femoral sac, are, he thinks, probably due to this developmental relationship with three branches of the main vessel of the limb, viz., superficial epigastric, circumflex iliac, and external pudic.

In a letter to the *Lancet*, November 17, 1906, Keith severely criticises these propositions. He questions the embryological facts on which they are based. He says, "All the evidence at our disposal points to the coincident formation, or pre-formation, of a peritoneal sac as the least essential part in the pathology of hernia. The essential part is the weakness or deficiency of the abdominal wall, through which a diverticulum of the peritoneum can be so easily forced. An examination of 70 fœtuses, varying in age from the sixth to the ninth month, revealed no trace of a funicular diverticulum; further, a careful scrutiny of the processes vaginalis in another 100 human fœtuses did not support the above-mentioned theory in explanation of irregular sacculation of the funicular process."

Murray (*Lancet*, February 10, 1906), dealing with the same subject, quotes Macready's statistics, and refers to his remarks as to the difficulty, during an operation, of distinguishing between a congenital and an acquired hernial sac. Murray thinks that an acquired hernia, for example, after a laparotomy wound, is closely comparable with an ordinary oblique inguinal hernia. Again, the so-called acquired hernia of adults is, in its anatomical conformation, exactly similar to a hernia of congenital origin. He comes to the conclusion that a preformed sac is always present, but that the occurrence of the hernia depends on two factors:—

(1) The size of the opening of the internal abdominal ring;

(2) The strength of the muscles guarding that opening.

The object of the radical operation should be to do away with any sign of protrusion of the peritoneum, and to preserve the internal sphincter intact. One hundred consecutive cases were examined post-mortem, in no less than 21 was a potential hernial sac present.

THE RADICAL CURE OF INGUINAL HERNIA AND ITS RESULTS.

A paper on this subject by Coley, in the *Annals of Surgery*, June, 1903, was perhaps the most exhaustive that had yet been published, and was based on no less than 937 cases of inguinal hernia. Since the publication of this paper, others have appeared dealing with large numbers of cases, so that the prognosis of radical cure, after a given method of operation, can now be more certainly stated than hitherto. A brief reference to Coley's statistics shows that the Bassini operation was performed in 917 out of 937 cases of inguinal hernia ; kangaroo tendon was employed for the buried sutures. Only 10 relapses occurred, that is a fraction over 1 per cent. In 181 female cases, there was not a single recurrence. The technique of Bassini's operation was strictly followed, except that kangaroo tendon was employed instead of silk. The patients were only kept in bed for two weeks, and did not subsequently wear any truss.

Jonathan Hutchinson, junior, read a valuable paper on this subject before the Medical Society of London, March 26, 1906. The paper was based on 500 operations for the radical cure of hernia, performed by him at the London Hospital, during the last 15 years. Of these, 360 were inguinal, 100 femoral, 50 umbilical, ventral, etc. There were 150 cases of strangulated hernia. A strict enquiry was made as to the permanent results of operation in this series. The standard of interval of time after the operation was originally fixed on a basis of two years, but the average time was found to be about six years. These operations were carried out mainly upon patients employed in occupations which entailed hard physical labour, and therefore the test of radical cure was a most stringent one. In these patients, a truss was not worn subsequently, and they often resumed work within six weeks from the time of operation. The author traced 109 cases of inguinal hernia, all of whom had completed the two years' limit at least. Excluding 9 cases of strangulation, there were 100 cases operated on for the radical cure. Eight of these had relapsed *in situ*, and, in 5, the recurrence was pronounced. In 7 cases, a fresh hernia had occurred at another site. The author concludes that recurrence usually takes place within 9 to 18 months after operation, but occasionally later. The results of this series of cases closely corresponds with those of other operators, who employed similar technique.

The external oblique was divided in nearly every case, and the inguinal canal sutured after Bassini's or MacEwen's method. Kangaroo tendon was invariably used for the buried sutures. The sac was dealt with as follows:—

A small opening was made in the abdominal wall near the anterior superior spine, and the twisted sac was brought through this and fixed to the abdominal wall by a double tendon suture which transfixed the muscles and the sac.

The author draws attention to the various methods of closing the inguinal canal, viz.:—

(1) Halsted's method, *i.e.*, complete obliteration of the canal between the external and internal rings behind the cord.

(2) Narrowing the canal in front of the cord by suturing down the muscles. (MacEwen, Wood, etc.)

(3) Narrowing the canal behind the cord. (Bassini.)

Among the eight cases of recurrence already mentioned, two were operated on by Bassini's method, one after MacEwen's method, whilst, in the remaining five, no attempt was made to close the inguinal canal.

Ortez de la Torre, of Madrid (*Zentralblatt für Chirurgie*, April 28, 1906), relates his experience in 500 operations on hernia. He recognises that, on an average, recurrence takes place in 10 per cent. He discusses three groups of causes for recurrence after operation.

(1) Depends on certain conditions of the hernia; for example, old age, the size of the hernial opening and its contents: especial stress is laid on a lax musculature of the abdominal wall.

(2) The employment of one method of operation only. He thinks that different conditions found at the time of operation demand different methods of technique.

(3) The condition of the patient subsequent to operation.

The value of rest for a long time after the operation is emphasised. For two months, there should be a complete rest from muscular exertion, and then a gradual return to normal. He considers it absolutely essential that a truss should be worn for a long period after operation. He is of the opinion that congenital hernia is frequently cured without any operation, and advises the use of a truss in the young with small herniæ. He prefers to operate during young adult life, when a spontaneous cure can no longer be expected. In young children, the operation recommended is a very simple one. The sac is not disturbed at all, but the aponeurosis of the external oblique is infolded by a row of sutures, a blunt instrument is inserted into the canal so as to protect the cord from the needle. In adults, Bassini's operation is recommended.

Noble (*Annals of Surgery*, March, 1906) contributes a paper on overlapping the aponeurosis in closure of wounds of the abdominal wall. This principle of treatment is also strongly advocated in the closure of hernial orifices. A similar procedure, now so widely used in the cases of umbilical herniæ, is of great value. The author claims priority in the introduction of this method, which has been popularised by Mayo, since 1898. He gives to Lucas Championniére the credit of first applying this principle to the radical cure of inguinal hernia. Noble has only had one recurrence in inguinal hernia since he practised this method of closure.

Baratynski (*Deutsche Med. Wochenschrift*, 1905, N.R. 51) discusses the relative merits of Bassini's and Kocher's methods. He recommends Kocher's operation in children, and when the inguinal canal is narrow, and the muscles well formed. Preference is given to Bassini's operation, if there is a wide interval between the deep muscular layers and Poupart's ligament.

Davis, of Philadelphia (*Annals of Surgery*, June, 1906), deals with the radical cure of direct inguinal hernia. Two methods of operation are recommended, depending on the position taken by the hernial sac. If the sac appears external to the conjoined tendon, the sheath of the rectus muscle is opened, and the muscle fibres are displaced outwards and sutured to Poupart's ligament. If the sac protrudes through, or displaces the conjoined tendon forwards, an operation is planned on the lines of the flap method for the cure of umbilical hernia.

THE RADICAL CURE OF FEMORAL HERNIA.

The number of complicated operations, devised for the radical cure of this form of hernia, is ever on the increase. This would seem to show that simple operations, such as ligature of the sac, and closure of the femoral ring, do not stand the test of time. In contradiction to this belief may be mentioned the startling figures, published by Coley in the *Annals of Surgery*, October, 1906. This paper embodies the results of the radical cure of femoral hernia in 117 operations performed by him between the years 1896 and 1906. Thirty-four of these were children up to 14 years of age, of the remaining cases, 12 were males and 65 females. He quotes Pott's paper (*Deutsche Zeitschr. für Chirurgie*, 1903), based on 933 cases of femoral hernia. The percentage of permanent cures in this series was found to be 70·5 per cent. In his own paper, Coley considers the relative merits of the different operations devised for the radical cure of femoral hernia. He reviews the different methods, and a comparison is drawn between simple ligature of the sac, and those more complicated operations recommended for the efficient closure of the femoral canal. He is strongly of the opinion that simple ligature of the sac is insufficient. He states that recurrence follows this procedure in 30—40 per cent. Although he recognises the importance of closing the canal by some method, yet he does not favour any of the elaborate operations recently advised for this purpose. In his series of cases, two comparatively simple operations for closing the canal have been employed. The Bassini operation was performed 15 times only, whilst, in the remaining cases, the femoral opening was closed by a purse-string suture of kangaroo tendon. This operation is a slight modification of that devised by Cushing, of Boston, in 1898. The results of this simple procedure are apparently ideal. In 100 cases so treated, not a single recurrence is reported to have occurred. One would like to inquire whether all the patients had reported their condition at a sufficient interval of time after the operation. On this basis alone can a true estimate of the ultimate value of the operation be founded. The author refutes the arguments, which have been advanced in favour of a more complicated obliteration of the femoral canal, and holds that the simple operation, which he describes, possesses the twofold advantages of simplicity and efficiency.

Jonathan Hutchinson, junior (*vide supra*), was able to trace the subsequent condition of 16 patients only over two years after the operation for femoral hernia. In these, two recurrences took place, one was an old woman with bronchitis. The method adopted in these cases was simple, viz., freeing the sac as high as possible, twisting it, and fixing it to the abdominal wall. The femoral canal was then closed by kangaroo tendon sutures, including Poupart's ligament and the pubic fascia.

Battle (*Medical Society's Transactions*, May, 1906, Vol. XXXIX.), in dealing with the radical cure of femoral hernia, describes the method devised by him, which he has carried out in the case of 65 patients since 1897. He is of opinion that it is essential to attempt to close the canal at its upper end, and not at its lower, and, with this object, the following technique was employed. The sac is isolated as usual, and the neck ligatured and freed as high as possible. The aponeurosis of the external oblique over the inguinal canal is next defined; the external ring is then enlarged by incising the aponeurosis upwards and outwards for 1½ inches, the lower of the two aponeuric flaps so formed is displaced outwards. The neck of the sac, with the ligature still attached, is then drawn through the femoral canal from within. The inner flap of the aponeurosis is then fixed down to the pectineus, so as to lie on the deep surface of the lower or outer flap and Poupart's ligament. This forms an effectual shutter to the femoral opening. The lower flap is finally sutured to the outer surface of the upper flap, so forming a double aponeurotic wall to the inguinal canal at its lower part. Battle has had good results from this operation, and has not yet observed any definite recurrences in a series of 65 cases. Silk was used for the deep ligatures throughout, silkworm gut for skin.

Nicoll (*Annals of Surgery*, January, 1906) writes on the radical cure of severe femoral and inguinal hernia. An account is given of the different operations practised for the radical cure of femoral hernia. An operation, which he planned in the first place for the cure of large herniæ, and which he now performs as a routine procedure, is described in this paper. The steps of the operation are as follows:—

(1) The sac is obliterated by splitting it vertically, interlocking the two halves and replacing them into the extra-peritoneal space. The femoral ring is next closed by making a transversed incision down to the pubes and reflecting the periosteum. The bone is then drilled in two places, and a mattress-suture is passed through Poupart's ligament and the holes in the bone. Poupart's ligament is then pulled down and fixed by this suture to the postero-superior aspect of the pubes; this effectually closing the femoral ring on the inner side. The detached pectineus and fasciæ are finally sutured to Poupart's ligament so fixed down in this manner. The principle of fixing down Poupart's ligament to the pubes is somewhat similar to that adopted by Roux. The author claims that his operation is a better one, as it avoids the necessity of leaving a foreign body *in situ*. He claims that it closes the femoral ring as close to its origin as possible, in fact, flush with with the peritoneal wall.

De Garmo, of New York (*Annals of Surgery*, August, 1905), describes a series of 110 cases of radical cure of femoral hernia extending over a period of 15 years. Only one actual recurrence took place. The important steps in the operation practised by him were:—

(1) Careful freeing of the neck of the sac, and tying the same as high as possible.

(2) Closing the femoral opening by means of a series of kangaroo tendon-sutures passed between Poupart's ligament and the soft tissues over the pubes.

INTERNAL HERNIÆ.

Several examples of so-called internal herniæ have been recently published.

Dennis (*St. Paul Medical Journal*, October, 1905) relates a case of a diaphragmatic hernia, which became strangulated in a young man aged 19. Eighteen months previously he had sustained an injury to the thorax which was severe enough to keep him in bed for three weeks. There was no penetrating wound. Laparotomy revealed a diaphragmatic hernia containing the stomach, omentum, and transverse colon. Great difficulty was experienced owing to omental adhesions in reducing the hernia from the abdominal wound, and a portion of rib was therefore resected, and the hernia reduced. The opening in the diaphragm was not sutured, but packed with gauze. The patient recovered, although an empyema developed later, and a further resection of ribs was undertaken. A short account of this rare form of hernia follows. The author states that the acquired diaphragmatic hernia is always traumatic, and is the result of three different forms of injury :—

(1) A penetrating wound.

(2) A severe contusion or concussion of the thorax.

(3) Repeated strains, which may, in certain cases, lead to the formation of a hernial orifice.

Operative treatment should be performed through the thoracic wall, because—

(*a*) It may be impossible to draw the escaped organs back into the abdomen on account of strong suction resulting from the negative pressure in the thorax.

(*b*) Because the suture of the diaphragmatic opening can be much more easily accomplished from the thoracic side.

A very unusual form of hernia, viz., into the foramen of Winslow, is exampled by a case published by Delkeskamp (*Beitrage für klin. Chirurgie,* quoted by the *Journal of the American Medical Association,* April 7, 1906). The patient was a healthy woman, aged 22. Signs of intestinal obstruction developed after normal labour. The abdomen was opened seven days after delivery, and a hernia into the foramen of Winslow was discovered; it was reduced without difficulty, and the patient made a good recovery.

There have been several cases reported of hernia into the various fossæ of the peritoneum.

Secord (*Annals of Surgery,* November, 1906) describes a case of hernia into the ileo-cæcal fossa. The rarity of this form of hernia is emphasised; in fact, the author claims that this is the first recorded example. This fossa, as described by Moynihan, is bounded in the front by the ileo-colic, or anterior vascular fold, behind by the ileum, its mesentery, and a small portion of the cæcum. The hernia occurred in a labouring man, aged 40, who gave a history of recurring colic with symptoms of partial intestinal obstruction. A tumour, apparently intestinal in origin, could be felt in the region of the ileo-cæcal junction. Operation revealed a hernia into the above-mentioned fossa. The contents consisted of appendix and cæcum, and the terminal 4 inches of the small intestine. One portion of the cæcum was in a sloughing condition. The mouth of the pouch was closed by sutures The sloughing portion of the cæcal wall was then fixed. The resulting fæcal fistula was eventually closed by a second operation two months later.

A case of Treitz' hernia, complicating gastro-enterostomy, is related by Barker (*Transactions of the Clinical Society*, Vol. XXXIX., page 137). The abdomen in this patient was opened with the intention of doing a gastro-enterostomy for a pyloric carcinoma which was present. On raising up the transverse colon, it was found that the entire small intestine had become herniated into a retro-peritoneal sac. The author comments on the difficulties which arise in performing a gastro-enterostomy, when this condition is present.

A case of right duodenal hernia is recorded by Paton (*Transactions of the Clinical Society of London*, Vol. XXXIX., page 139). This occurred in a female infant, aged 3 months. The symptoms were, sudden abdominal pain and vomiting. No abdominal tumour could be made out, and there was no passage of blood and mucus per anum. An exploratory laparotomy revealed what appeared to be a broad band under which some portions of the gut were imprisoned. The coils of gut were easily drawn out, but the condition of the child forbade further interference. All symptoms were relieved for six days, when vomiting recurred, and death followed. The post-mortem examination revealed the presence of a sac, the opening of which was on the right surface of the mesentery near its posterior attachment. The superior mesenteric artery bounded its anterior wall. Some coils of ileum lay in this pouch, but were not strangulated. The pouch in which this hernia took place was formed by the inconstant fossa of Waldeyer.

Sherren (*Transactions of the Clinical Soicety of London*, Vol. XXXIX., page 99) reports a case of strangulated left duodenal hernia, occurring in a girl, aged 12. The symptoms were those of acute obstruction with severe onset. A resonant fixed tumour was felt in the abdomen close to, and slightly to the left of the umbilical region. A hernia of the small intestine was found lying in a pouch to the left of lumbar spine, the opening of the sac looking upwards, backwards, and to the right. The inferior mesenteric vein was in relation to its upper and left border, whilst the inner end of the peritoneal fold was lost on the duodenum and the left side of the root of the mesentery. The sac was closed by sutures so far as possible. The patient made a good recovery.

A reference is made to the records of ten reported cases of this form of hernia with four successful operations.

Dobson (*Annals of Surgery*, November, 1905) refers to an interesting case of meso-colic hernia found in the body of a still-born hydrocephalic fœtus. The hernial sac lay to the left of the jejuno-jejunal flexure, and extended between the layers of the transverse meso-colon as far as the splenic flexure of the colon. It contained two coils of jejunum. Dobson thinks that this case is an example of hernia into a para-duodenal fossa (Jonnesco) from the position of the sac, and its relation to the ascending branch of the left colic artery, which lay on the free border of the sac. The inferior mesenteric vein, which is the guide to the fossa of Landzert, was seen in the parietal peritoneum, some distance from the neck of the sac in this specimen.

INTESTINAL OBSTRUCTION OCCURRING AS A SEQUEL TO THE REDUCTION OF A STRANGULATED HERNIA.

This complication, occurring after operation on, or reduction of, a strangulated hernia, has been recorded, but it is of comparatively rare occurrence. Probably many cases occur of which no record is made. When one considers the frequency of strangulated hernia, and the fact that marked changes are usually present in the gut wall as the result of neglect or violent taxis, it is remarkable that recovery is, as a rule, so complete and permanent. Nevertheless, the complication is a well-recognised one, and it is placed among the causes of a certain form of intestinal obstruction.

Treves, in his text-book on intestinal obstruction, 1899, refers to the records of 11 cases. The constriction occurred always in the small intestine; the symptoms appear, as a rule, within six months after the reduction of the hernia; the strictures were either annular, tubular, multiple, or due to valvular folds of mucous membrane. He discusses the formation of omental bands as a cause, but considers that this is not common.

Recently two papers have been published which deal with this subject in detail, more especially with regard to the causation of the constriction.

Cotte and Leriche (*Revue de Gynecol et de Chir. Abdominale*, 1905, N. 2) based their paper on the literature, in which they have found records of 80 cases. They find that this form of obstruction occurs more commonly in men, the subjects of inguinal herniæ. The frequency of cases, observed after inguinal hernia, is, in comparison with femoral hernia, as 3½ to 1. It was noticed twice after umbilical herniæ. The constriction of the gut is either due to—

(*a*) Adhesions.

(*b*) A ring-like or tubular stricture due to cicatricial change occurring in the ulcerated mucosa.

The ring form of stricture corresponds to the groove caused by nipping of the gut at the neck of the sac. The symptoms caused by the obstruction may be acute or chronic. Hæmorrhage from the bowel, occurring some days after the reduction of the hernia, should lead one to suspect the possibility of later trouble. The author strongly deprecates taxis in the treatment of strangulated hernia, and points out how liable it is to cause both immediate damage to the gut wall, and later ulceration, with possibly consecutive stenosis. For the treatment of this condition, resection of the gut is generally indicated, but, in special cases, lateral anastomosis should give good results.

Meyer (*Deutsche Zeitschrift für Chirurgie*, Bd. LXXVI., page 296) bases his paper on the case of a woman, aged 60, who developed signs of intestinal obstruction three weeks after herniotomy. A coil of adherent and obstructed intestine, kinked into an S-shaped loop, was found on opening the abdomen. A lateral anastomosis was performed, with good results. Meyer divides the cases into two groups:—

(1) True ring-like or tubular stenosis.

(2) S-shaped or irregular coils of intestine, with or without true stenosis.

The latter group is slightly the more common. This authority also strongly deprecates the practice of taxis in strangulated herniæ, and thinks that it may be responsible for lasting damage to the gut wall. As regards the clinical signs of the condition, he describes :—

(1) A short interval after the herniotomy, in which symptoms are in abeyance.

(2) Characteristic signs of obstruction, often preceded by diarrhœa.

The site of the lesion is generally in the small intestine, a ring-like stricture, either single or double, may occur. This corresponds to the effect of the constricting agent at the hernial orifice. Tubular stenosis occurs, as the result of pathological changes, and takes place in the coils of strangulated gut. The author distinguishes :—

(1) Internal scar stenosis from the mucous membrane ulceration.

(2) External scar stenosis, due to changes in the serous coat.

With regard to treatment, Meyer discusses resection, lateral anastomosis or entero-plasty. He favours anastomosis in the majority of cases.

A REVIEW OF RECENT WORK IN ABDOMINAL SURGERY.

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TREATMENT OF DIFFUSE SUPPURATIVE PERITONITIS.

THE modern views, with regard to the capability of the peritoneum to deal effectively with acute bacterial invasions, when once the source of such infections has been removed, are well shown in an article by Hotchkiss, in the *Annals of Surgery* (1906, Vol. XLIV., p. 197), which reflects the latter-day tendency to remove the cause of peritoneal inflammations early and with as little injury and handling of the tissues as possible, and to avoid such fallacious measures as attempting to cleanse the peritoneal cavity.

Including only those cases of peritonitis due to appendicitis, in which free pus was present, and its limits were not generally definable, excluding cases of large secondary encapsuled collections of pus in the pelvis, Hotchkiss records 43 cases, of which number only 5 died.

The method of operation was, briefly, as follows :—the appendix was searched for and removed with as little disturbance to the intestines as possible. After its removal, and the cleansing of the appendiceal site, the pelvis and lower abdomen were rapidly washed out with a return flow cannula (Blake).

The peritoneum was closed in many cases without attempting to remove the saline solution which had not run out.

The external wound down to the peritoneum is generally drained, as it is usually infected. Gastric lavage is given before the patient leaves the operation table.

As a rule, an ounce or two of a saturated solution of Epsom salts was introduced through the tube and left in the stomach. Morphia was avoided as far as possible. Rectal saline irrigation was used every 6 to 8 hours for the first two days.

The writer advocates the Fowler position after operations solely with a view to increasing the patient's comfort, more particularly in regard to respiration ; he does not believe that posture can influence the drainage of peritoneal secretions.

Robson, (*Lancet*, Dec. 29th, 1906), reviews the growth of the modern treatment of peritonitis, quoting the published results of various operators, the majority of whom differ from one another in some slight modification of technique.

Robson considers the salient points of treatment to be: 1. removal of the cause with, or without, irrigation of the peritoneal cavity; 2. drainage of the site of operation and of the pelvis, aided by the semi-sitting posture; 3. rapidity of operation; 4. avoidance of unnecessary exposure and handling of the viscera; 5. the prevention of shock; 6. the administration of saline fluid by the rectum; 7. rectal alimentation and stoppage of mouth feeding; and 8. the avoidance of opium, and sometimes the administration of repeated small doses of calomel after operation.

It is interesting to note that a similar degree of success has been attained by many surgeons, though one favours the promotion of intestinal rest by the administration of opium, another advocates free action of the bowels by saline or other purgatives, one believes in local irrigation without subsequent drainage, while another is content with mere local sponging and tube drainage.

These are the results chiefly of the treatment of peritonitis due to perforation or necrosis of the lower portion of the intestinal tract, as exemplified by acute appendicitis.

SURGERY OF THE STOMACH.

Jejunostomy.

The applications of jejunostomy to conditions, other than malignant disease of the stomach, formed the subject of a discussion at the French Society of Surgery (*Bull. et Mém. de la Soc. de Chir.*, 1906, Vol. XXXII., p. 596).

Lejars has employed it in certain forms of gastric ulcer, particularly in certain benign affections of the stomach, characterised by the persistence of the vomiting, and by the complete intolerance of the stomach. Maydl has published numerous observations of this kind.

Lejars reports the final results in three cases. The first patient was a man, who suffered from daily vomiting, which followed the least ingestion of liquid; the man was very wasted and pale and had lost weight rapidly. At the operation, no lesion of the stomach could be found. Jejunostomy by von Eiselsberg's method was performed. The results were very good, and, at the end of 2½ months, the jejunal orifice was allowed to close. The gastric symptoms have not recurred.

The second patient gave a history resembling the preceding, though it extended over a longer period of time. A few adhesions were found at the pylorus, and a small fibrous tumour, the size of a bean, on its anterior wall. Jejunostomy was performed, and, at the end of some months, the patient recovered a very good general condition. The stoma was open 5 months later.

The third patient had also vomited all kinds of liquid food, and, one year previously had had an abundant hæmatemesis and melæna. The appearance of the stomach and duodenum was normal. Jejunostomy was followed by the immediate relief of the pain, but, 3 months later, his condition again became precarious, and a gastro-enterostomy was performed, the fistula being closed. This second operation was followed by temporary improvement, but after 3 weeks, the patient became rapidly enfeebled and died. At the autopsy, the gastric mucosa was found thickened and sown over with multiple ulcerations.

Judging from these three patients, the operation in this class of cases is not satisfactory. In the last two cases, a primary gastro-jejunostomy would have been preferable, and while, in the first case, the results tend to show that, in certain gastric ulcerations without stenosis, or rebellious gastric intolerance, jejunostomy may at times be followed by a lasting cure, yet gastro-enterostomy always remains the operation of choice.

In other conditions, and, especially in extensive burns ot the stomach, the creation of a jejunal mouth may be a most valuable proceeding. It is applicable to the initial period of gastro-œsophageal burns, when oral feeding is impossible; and also during the cicatricial period, at the time of the combined stenosis of œsophagus and pylorus, or of complete fibrous contraction of the stomach.

The method to be preferred is that practised by von Eiselsberg, since 1894, a modification of Witzel's gastrostomy applied to the intestine.

Gastrostomy.

In the *Zentralbl. f. Chir.* (June, 1906), Tavel describes a new method of performing gastrostomy. A loop of the upper jejunum is drawn out and divided in two places. The continuity of the bowel is restored by axial anastomosis, and the isolated segment, about 2 or 3 inches in length, is then drawn through an opening in the transverse meso-colon and through the gastro-colic omentum, its mesentery being preserved intact. One end of this segment of gut is implanted into the anterior stomach wall, and the other end is fixed to the skin.

It appears scarcely likely that so complicated a procedure would often be applicable to the old and weakly patients, who are the subjects of malignant œsophageal stricture, while the permanence, claimed by its originator for this method, becomes of less importance, in cases of fibrous stricture, where a temporary means of warding off starvation is alone needed.

GASTRIC DIAGNOSIS.

It has come to be recognised, in gastric surgery, that the ability to make a pre-operative diagnosis is a matter of the utmost importance, for not only will it lessen the time consumed over operative procedures, but it enables the surgeon to avoid opening the abdomen for conditions, which cannot be benefited by mechanical means, or are beyond the reach of surgical help.

The diagnostic value of an investigation of the stomach secretion has, recently, attracted considerable attention from numerous workers.

The production of the lactic acid bacillus has been recently investigated by Sick (*Deutsches Archiv f. klin. Med.*, Bd. LXXXVI., H. 4–5). He finds these bacilli in many conditions of the stomach apart from carcinoma. They can be cultivated from the intestines in persons with a decreased acidity, but they are not found associated with neoplasms when free HCl is present. He concludes that, for clinical examination, the presence of fatty acid is not such a certain sign upon which to make a diagnosis of carcinoma as is the presence of lactic acid.

Reicher (*Archiv f. Verdauungskrankheiten,* Bd. XII., 3) discusses Salomon's test, which was carried out as follows :—

On the day before the test, the patient is fed on an albumen free diet; in the evening, the stomach is washed clean, and during the night nothing is allowed by the mouth. In the morning, the stomach is washed twice with 400 cc. normal salt solution. This is afterwards tested with Esbach's reagent, and by Kjeldahl's method for total solids.

According to Salomon, if carcinoma is present, Esbach's reagent produces a flocculent precipitate, and Kjeldahl's method shows more than 25 mg. total solids per 100 cc. The majority of other stomach affections (including chronic ulcers) produce only at most a slight cloudy precipitate with Esbach's reagent and only 16 mg. Kjeldahl. Reicher shows the uncertainty of the method, and points out that the reaction can take place with numerous bodies, mucin, purin-bases, nucleo-proteids, etc., which are precipitated by Esbach's reagent.

Boas (*Zentralbl. f. innere Med.*, 1906, No. 24) describes a new reagent for the detection of occult blood in the stomach contents and fæces. The stomach contents are treated in the usual manner with glacial acetic acid and ether. To the ethereal extract are added 1 or 2 drops of p-phenylendiamin-hydrochlorate in every dilute solution. Finally, 10 to 15 drops of 3-per cent. hydrogen peroxide are added, and the mixture shaken. In the present of occult blood, an olive-green ring appears at the junction of the peroxide with the ethereal extract. While the method will hardly supplant the guaiac and aloin tests, it apparently deserves to be placed by their side for confirmative purposes.

Maragliano (*Riform. Med.*, XXII., No. 33; *Journ. Amer. Med. Assoc.*, Vol. XLVII., No. 18) has found that, by injecting cancer juice, obtained from the stomach of patients suffering from carcinoma of the stomach, into animals, he is able to obtain a serum, which gives a precipitate with the gastric juice obtained from a case of gastric cancer. The exact method of procedure is somewhat lengthy, but he is now using it as a means of diagnosis.

A report on the Desmoid reaction, as a means of diagnosis in gastric disorders, is published by Horwitz (*Archiv f. Verdauungskrankheiten*, Bd. XII., No. 4).

He has applied the test in 44 cases, and considers it of great diagnostic value. The bags are made of thin rubber tissue and tied with fine catgut; in addition to using the little bag filled with methylene blue and iodoform, he has obtained useful information from a combination of radioscopy with the ingestion of the little bag filled with bismuth.

If the bag is visible after 3 hours in the stomach or intestines, a deficiency or absence of HCl is indicated. If the catgut is digested in 1½ hours, as seen by the diffusion of the shadow of the bismuth, hyperacidity of the gastric secretion may be assumed.

In *Surgery, Gynæcology and Obstetrics*, June, 1906, a method of examination of the stools, as an aid in the diagnosis of carcinoma of the stomach, is described by Elliot.

The method is based on the fact that the Boas-Oppler bacillus, found in the gastric contents in carcinoma of the stomach, survives and multiplies in its passage through the gastro-intestinal tract, even to such an extent that it may numerically exceed the colon group in the fæces. This has been shown to be the case by Schmidt.

Moreover, the Boas-Oppler bacillus is Gram-positive, whereas the normal bacillary flora of the large intestine is mainly Gram-negative. Thin smears are made from the stools upon cover-slips, these are dried, and then fixed for five minutes in methyl-alcohol, and then stained by Gram's method, being finally counterstained in a weak aqueous fuchsin solution. In a normal stool the Gram-negative bacilli far outnumber the Gram-positive elements, while even where the latter are more numerous, they are found to be of all morphological varieties. The "Gram-positive" stool, as found in gastric carcinoma, is recognised, not only by the staining reactions of the organisms, but also by their uniformity in size and shape.

Out of 25 cases, examined by the author, 7 were Gram-positive and 16 Gram-negative, while 2 were almost exclusively Gram-negative. Of the 7 Gram-positive, 6 were from cases of carcinoma of the stomach, 5 of these were confirmed by post-mortem or operation, and 1 was acute gastric ulcer. Of the 16 Gram-negative films, one occurred in cancer of the stomach, the remainder being cases of benign gastric disorders, cholelithiasis, or other conditions. Of the two almost exclusively Gram-negative, one was a case of cirrhosis of the liver, and one a chronic nephritis. According to Schmidt, the presence of a Gram-positive coccus stool is indicative of an ulcerative process, either in the stomach or in the intestines.

Pyloric Stenosis in Infants.

The operative treatment of this condition, based on the records of 71 cases, is discussed by Fisk (*Ann. of Surg.*, 1906, Vol. XLIV., p. 1), who also gives a short account of the symptoms, pathology, and ætiology of this affection.

After mentioning the theories which have been advanced to explain the ætiology of this disease, he discards that which attributes it to a spastic contraction of the pyloric sphincter, on the grounds that all the cases operated upon, and all those which have come to autopsy, have shown similar definite anatomical lesions. Looking at the matter from this point of view, he considers that all cases should be submitted to surgical treatment after a week or ten days' careful feeding. Delay longer than this is inadvisable, for the statistics tend to show that early operation is a more important factor than method of operation in the attainment of a successful result.

The methods of operative treatment, which have been most favoured, are gastro-enterostomy, pyloroplasty, and divulsion. The last operation is not infrequently followed by recurrence, the best procedure would therefore appear to be either gastro-enterostomy, or pyloroplasty. Of these the author favours pyloroplasty on the grounds that it is physiologically, anatomically, and surgically the more correct procedure.

Perforated Gastric and Duodenal Ulcers.

In a paper read before the Edinburgh Medico-Chirurgical Society, Miles gives his conclusions derived from a personal experience of 46 cases of perforated gastric and duodenal ulcers. As regards the previous symptoms, he had been struck by the comparative rarity of a history of hæmatemesis or melæna. The amount of food in the stomach seemed to have no definite connection with the perforations, nor, apparently, did it influence the prognosis.

In his series there was only one example of multiple perforations. Among the symptoms of perforation he placed great reliance on the sudden occurrence of pain, and he considered the seat of the pain an important guide to the site of the ulcer. Vomiting was not common when perforation occurred, but abdominal rigidity was constant and early. He did not place much reliance on variations in the liver dulness.

As regards operative treatment, he could not recommend excision of the ulcer, and did not care to perform gastro-enterostomy as a matter of precaution. The peritoneal cavity should be irrigated and drained above the pubes. Local drainage he no longer employed, but used Fowler's position.

SURGERY OF THE BILIARY TRACT.

Non-calculous Cholecystitis.

Fairchild (*Journ. Amer. Med. Assoc.*, Aug. 12th, 1905) says that, in this condition, the clinical picture often leads to some confusion in diagnosis, for the characteristic colic of gall-stone disease is absent. A feeling of nausea, pain in the region of the gall-bladder, with chills, and fever, and sometimes slight transient jaundice are the clinical evidences in these cases. The walls of the gall-bladder are found to be thickened, and, in some cases, the mucous membrane may be ulcerated. Non-calculous cholecystitis has been said to be usually of a catarrhal type ; but that this is not necessarily so is evident from the occasional presence of ulceration, or of pericholecystitis.

The results of cholecystostomy, with a short period of drainage in the milder cases, are as good as in the uncomplicated cases of calculous cholecystitis. In the more severe cases, the mortality is higher, and convalescence more protracted. As regards the treatment of these severe cases, Fairchild prefers drainage to removal of the gall-bladder.

An interesting case of ulcerative cholecystitis, not occurring in connection with gall-stones, is described by Locke and Wolbach in the *Boston Medical and Surgical Journal* (June 21st 1906). In this case, the sudden onset of symptoms suggested a severe attack of appendicitis, but operation revealed nothing abnormal. After the operation, the patient developed a local abscess followed by peritonitis, and died on the 23rd day. At the autopsy, the mucous membrane of the gall-bladder showed many deep, circular, undermined ulcerations from 1 to 8 mm. in diameter, two of these had perforated the gall-bladder wall. The bile ducts were patent, and there were no calculi found. The interest of the case lies in the fact that neither in the history, nor at the post-mortem examination, were there found any evidences of gall-stones.

A somewhat similar case of acute perforating ulcer of the gall-bladder is recorded by Worthington, (*Archiv of the Path. Inst. of the Lond. Hosp.*, Vol. I., 1906). This patient gave a history of acute abdominal pain of sudden onset, nausea, and vomiting. On admission, the abdomen was slightly distended, and tender on deep pressure. The abdomen was opened on the third day of the illness, peritonitis was everywhere present, though no cause could be found for it. A patch of lymph was found adherent to the gall-bladder, but this was not specially remarkable, as similar flakes of lymph were scattered over all the viscera. In the right flank was found a collection of gelatinous fluid of yellowish colour.

At the post-mortem, the inner surface of the gall-bladder presented a circular, clean cut ulcer, ¼ inch in diameter, near the fundus. This had perforated the gall-bladder wall, though the perforation was closed externally by a plug of adherent lymph. The edge of the ulcer was not thickened, and the rest of the gall-bladder appeared healthy. A few grains of sand were found, hardly worthy of the name of calculi. The bile ducts were normal.

Operations on Gall-bladder and Bile Ducts.

In the *Annals of Surgery* (1906, Vol. XLIV., p. 209), W. J. Mayo passes in brief review the results of 1,500 operations upon the gall-bladder and bile ducts, performed by himself and C. H. Mayo, between June 1891 and May 1906.

In this series there were 845 cholecystostomies, with a mortality of 2·13 per cent. In the entire series of 1,500 operations, there was but one followed by a recurrence of gall-stones in the gall-bladder. Cholecystectomy was performed 319 times; mortality, 3·13 per cent. The authors prefer this operation to cholecystostomy when circumstances permit of easy removal of the gall-bladder, and the disease is confined entirely to this organ.

Cholecystectomy is clearly indicated in cases, in which the cystic duct is occupied by a firmly-impacted stone, and in which the gall-bladder is thick-walled and functionless, for, in the former case, cholecystostomy is liable to be followed by a mucous fistula, while, in the latter, carcinoma not infrequently supervenes. In connection with common duct surgery, cholecystostomy is preferable to cholecystectomy, unless there is some direct indication for the latter operation, for the gall-bladder affords an easy means of drainage, and is also a safe guide to the deeper ducts should further interference be necessary.

The 207 operations upon the common duct were divided up into four groups. The first group contained 105 cases, in which gall-stones were present in the common duct without immediately active symptoms. There was comparatively little infection of the ducts, the operation was simple, and the period of stay in hospital was short. The mortality among such cases amounted to 2·9 per cent.

In group 2 were 61 cases, with a mortality of 16 per cent. There was active infection involving not only the common duct, but also in the intrahepatic ducts; the patients were jaundiced, and suffered from irregular chills and intermittent pains. Stones in the hepatic duct were seen in 7 cases. In this group, in which cholangitis was a marked feature, coincident inflammatory changes in the pancreas were most often met with.

There were 29 cases, with a mortality of 34 per cent., in group 3. These patients had complete obstruction of the common duct. There was almost no bile in the ducts, and the little present was of a dark green colour, or, in the worst cases, complete acholia was present, the ducts being filled with a clear colourless mucoid secretion. In the long standing cases there was sometimes œdema of the feet, and free bile stained fluid in the peritoneal cavity.

If possible, it is advisable to wait for a period of remission before operating. In four cases the complete obstruction was suddenly relieved by the formation of a fistula, and the passage of the calculus into the intestine. Three of these patients required subsequent operations, when the common duct was seen to be densely adherent to the duodenum at the site of the perforation.

The fourth group comprises 12 cases of malignant disease.

Mortality, 33 per cent. Two forms of carcinoma were met with; a primary tumour of the common duct or papilla, which tends to remain localised until a late stage; in two cases excision of the growth was performed successfully.

The second class of carcinoma of the common duct is that where the growth spreads downwards from the gall-bladder, or originates in the head of the pancreas. Such cases are inoperable.

In a recent article, (*St. Louis Med. Rev.*, July 1906) based on sound observation, and distinguished by its grace of style, Maurice H. Richardson discusses the surgery of the biliary tract, with especial reference to the diagnosis. He insists on the fact that the early symptoms of gall-stones, other than those of impaction, may only be elicited by careful attention to the history, which may be a history merely of pain. A description of the nature and intensity of the pain will vary greatly according to the patient's temperament, and, when partly obliterated by the lapse of time, even severe symptoms may appear trivial. In this connection he records a case of intestinal obstruction caused by a gall-stone which had never given pain.

Among other diagnostic errors, he mentions the frequent mistake of assuming that attacks of intermittent jaundice are due to the passage of calculi from the common duct into the duodenum, whereas a stone impacted in the common duct is more often the cause of the condition. In discussing certain points in the treatment of these conditions, the author lays stress on the importance of both digital and visual examination of the ducts, and directs attention to the advisability of passing the scoop up the hepatic duct into the depths of the liver, if any part of this tract contains calculi.

Graham (*New York-Philadel. Med. Journ.*, Nov. 18, 1905) treats of the diagnosis of gall-bladder disease after a study of 135 consecutive examinations followed by operation in the Mayo's clinic. In the elucidation of pain in the upper abdomen, a carefully taken history will, in most cases, enable one to eliminate disease of the stomach or duodenum. It is interesting to note that over 90 per cent. of patients, complaining of little else than sudden pain and occasional vomiting, the so-called "neuralgia" of the stomach, proved to be suffering from gall-bladder disease. The majority of the patients suffered from a series of short attacks of epigastric pain with, or without, radiation, and often accompanied by vomiting. On the other hand, there may be no pain; chills, fever, and jaundice being the predominant symptoms; this is particularly the case in common duct cases. But jaundice has been met with in many cases, in which no stones were found in the common duct.

In this series, there were 10 patients giving a history of jaundice, who had stones in the gall-bladder or cystic duct, but in whom the common duct was free. Conversely, there may be a stone in the common duct, and yet the patient has had no jaundice; there were seven such in the series under consideration. The cases of cholelithiasis, most likely to be mistaken for gastric or duodenal ulcer, are those in which the gall-bladder contains one or two large stones and is shrunken upon its contents.

The American Journal of the Medical Sciences (Vol. CXXXII., pp. 446 and 774, 1906) contains a valuable paper by A. O. J. Kelly on "The Infections of the Biliary Tract." His observations are based upon a clinical and pathological study of 216 operative cases.

Cultures from the biliary tract, taken at the time of operation in 70 cases, yielded a growth in a little over 50 per cent., and of these 64 per cent. (or 33 per cent. of the total number of patients) gave a pure culture of B. Coli. The typhoid bacillus occurred in 19 per cent. of the infected cases (10 per cent. of the total). No bacteria were found in 48·6 per cent.

The question of the pathways of infection receives lengthy consideration; Kelly is inclined to believe that the portal circulation is the pathway of infection most usually favoured, especially in invasions by the B. Coli and typhosus, though he admits that these organisms may find their way into the biliary passages *viâ* the ampulla of Vater and common duct.

In the case of a colon infection by the latter route, the lesions are apt to be more abrupt in onset, and more manifest clinically.

Although the author relegates direct infection from the duodenum to the place of second importance, he takes into consideration the experiments of Bond on ascending currents in mucous gland ducts, and says that, although it cannot be denied that infection does sometimes occur by this route, yet in the past its importance has been over-estimated.

Cholecystitis, occurring as a complication of a general infection, as in pneumonia or influenza, is doubtless sometimes due to systemic infection. Kelly points out that infection, by way of the hepatic artery, is a descending infection of the bile ducts similar to infection carried by the portal circulation, but it is possible that infected blood, carried by the hepatic artery, may rarely lead to infection of the gall-bladder without the intermediation of the bile.

Latent biliary infections are discussed particularly in connection with typhoid infections of the gall-bladder occurring in the course of typhoid fever. Such cases may remain latent for years. Among the seven patients, from whom the typhoid bacillus was isolated at the time of operation, four were apparently examples of primary typhoid cholecystitis ; the remaining three cases had had typhoid fever previously (9 weeks ; 15 years ; 1 month). In addition to these, a positive Gruber-Widal reaction was obtained in two cases, both of which gave a history of a former attack of typhoid fever (15 months and 7 years), from one of these, the colon bacillus only was isolated at the time of operation ; no cultures were taken from the other. An interesting feature of many of the typhoid infections of the biliary tract is the seriousness of the lesions.

With regard to the ætiology of cholelithiasis, the chief causative factors, inflammation and obstruction, are briefly alluded to, and the bearing of these on the constituents of gall-stone, the differing constitution of calculi formed in the gall-bladder, and those which originate in the intra-hepatic ducts being ascribed to differences in the lining epithelium, which varies in its secretion under the stimulation of a low grade inflammation.

The influence of the popular diathetic or constitutional faults in the ætiology of biliary calculus formation is considered by Kelly to be of very minor importance. The type of inflammation which initiates gall-stone formation is, as a rule, mild ; the rôle played by bacteria, in the secondary infections following on the formation of gall-stones, is of greater consequence. The clinical manifestations of these remote consequences are discussed under the headings of pain, jaundice, size of gall-bladder, and fever; the clinical records of the 216 cases furnishing the basis for the deductions.

The accepted notion of the frequency of symptomless gall-stones is emphatically combated by the writer, who points out that these so-called symptomless stones have usually proclaimed their presence by a long series of attacks of "indigestion" which has been erroneously attributed to the stomach. The typical biliary colic is due, in the great majority of cases, to infection, and consequent inflammation, and should be interpreted, not as evidence of the passage of a stone through the biliary ducts, but as evidence of an acute cholecystitis. Jaundice is frequently due to inflammatory swelling obstructing the ducts, the gall-stones being merely an ætiological factor in the infection. On the other hand, an absence of jaundice should not discount the diagnosis of cholelithiasis.

The heading "Size of the Gall-bladder" leads the writer to a discussion of the value of Courvoisier's law, and though he would not decry the general trustworthiness of this law, yet he points out that, in 40·5 per cent. of 116 patients who had gall-stones and jaundice, the gall-bladder was enlarged. It is true that, in over one half of these cases, the gall-bladder alone contained calculi, and the jaundice was due to inflammatory swelling, etc. It is obvious that a contracted gall-bladder would not be met with at an early stage of the disease, and yet, at this period, the gall-bladder might well be distended, while an infection or the pressure of a large stone in the cystic duct, obstructing the common duct from outside, might give rise to concomitant jaundice. The indication for medical treatment is the biliary infection, and the most favourable result to be attained by medicinal treatment is the restoration of a condition of latency, in other words, alleviation of infection.

Surgical intervention is called for in cases of severe infection; fortunately, the majority of cases of infection subside spontaneously, or under medicinal treatment, operative measures may then be undertaken later under more favourable conditions.

Operation is indicated in all cases of persistently enlarged gall-bladder. Impaction of a stone with chronic jaundice also calls for operation, and it is indicated in those obscure cases, commonly diagnosed as indigestion, in which the presence of adhesions is strongly suspected.

The author considers that two, certainly three, attacks of gall-stone colic, apart from other symptoms, is sufficient indication for operation; but he does not advise the removal of stones that are, and have always been, quiescent.

SURGERY OF THE APPENDIX.

Malignant Disease of Appendix.

The published cases of primary malignant disease of the appendix, up to the beginning of 1906, have been collected and studied by Rolleston and Jones (*Amer. Journ. of the Med. Sci.*, 1906, Vol. CXXXI., p. 951).

They are able to accept for the purposes of analysis 42 cases. In 33 of these, the appendix was removed during life, and 27 of these had had symptoms of appendicitis. In the majority of the cases, a typical appendicectomy was performed, and the results have been remarkably good. Four patients died within two weeks of the operation; of the remaining 29, one died four months later after an operation for obstruction caused by a band, no recurrence was found post-mortem. None of the other patients can be found to present any sign of recurrence. After studying these figures, the authors conclude that it is not possible to diagnose the condition during life before operation; that the growth is usually a spheroidal-celled cancer, remarkable in its early age incidence, its slight malignancy and its resemblance to endothelioma.

In the same number of the Journal, a case of primary carcinoma of the appendix is reported by McAdam Eccles.

The patient was a youth of 18, whose symptoms pointed to appendicitis. The appendix was removed, and was found to be greatly thickened, measuring 2¼ inches in circumference; one or two lymph glands were also removed from the meso-appendix. The microscope revealed spheroidal celled carcinoma. The patient was well 21 months later.

False Diverticula of Appendix.

Seelig (*Ann. of Surg.*, 1906, Vol. XLIV., p. 78) draws attention to false diverticula of the appendix. The condition was brought to his notice by the examination of a specimen removed during the course of an abdominal hysterectomy. There was no history pointing to previous appendix trouble. He believes that such a condition may occur as the late result of an attack of acute appendicitis; a local destruction of the muscular coat being produced by the inflammation (with or without perforation), which will allow a subsequent bulging of the mucosa, due to increased pressure within the appendix.

Such diverticula form a constant menace, as their mouths are liable to become obstructed, and the absence of any muscular covering renders their walls subject to perforation.

Foreign Bodies in the Appendix.

Patterson (*Amer. Journ. of the Med. Sci.*, 1906, Vol. CXXXI., p. 859) has reviewed the literature on this subject, and to the recorded cases has added one of his own.

Such accidents are far less common than was formerly thought to be the case, and the traditional orange and grape seeds form but a small number of the interesting objects found in this situation. Pins head the list with a large majority: other fairly common objects being shot, thread and round worms, fragments of bone and tooth-brush bristles

SURGERY OF THE LARGE INTESTINE.

In the surgical treatment of carcinoma of the sigmoid and rectum, there is a noticeable tendency to the adoption of the abdomino-perineal route wherever possible.

According to C. H. Mayo, (*Surg. Gynæcology and Obstetrics*, August 1906, Vol. III., p. 236), the sacral operations for cancer of the rectum, occurring more than 2½ inches from the anus, are unsatisfactory. Judging from the anatomical conditions in the parts involved, he thinks that the hitherto disappointing results, so far as eradication of the disease is concerned, should be improved. Even in successful cases, free from recurrence, the functional result is often unfortunate.

He emphasises the fact that carcinoma of the sigmoid or rectum is a growth, occurring in a removable structure, slow to disseminate infection, and yet only one half of the cases are recognised at a stage, while yet there is a fair chance of operative removal. The warning sign of hæmorrhoids is often neglected. Another cause for the high percentage of recurrence is the inefficient access to the lymphatic drainage area afforded by the sacral route. According to the writer, the operation of choice for high rectal cancer is a combined abdomino-perineal method. The abdomen is opened with the patient in the extreme Trendelenburg position. The lower part of the sigmoid is clamped and divided on a level with the sacral promontory; the proximal end is brought outside the wound and securely closed. The end of the lower segment is similarly closed, and lateral and anterior peritoneal incisions made, liberating the rectum from the bladder and prostate or uterus. The inferior mesenteric artery is caught and divided a little above and to the left of the sacral promontory; the whole mass, including fat and lymph glands, is then wiped down towards the pelvis, leaving the periosteum bare, and exposing the internal iliac vessels and ureter. If, by this means, it is found possible to get well below the growth, the bowel may be clamped, ligatured, and divided, and the diseased segment removed. In any case, when the lower end has been freed as low down as possible, it is pushed down into the pelvis, and the operation area packed with gauze. The patient is then placed in the perineal posture, and a pair of forceps is passed up into the blind end of the bowel from below, and the gut drawn down and invaginated; if the growth has not been already removed, it is now cut away. The instrument is now passed up through the invaginated bowel into the pelvis, and the proximal end seized and withdrawn; circular end-to-end suture is then performed (Barker's method), and the intestine allowed to retract. Drainage is secured by an incision in front of the coccyx, through which a tube is passed into the pelvis. If the removal has been so extensive as to give little hope of a satisfactory functional result, the sigmoid loop should be retained for its usual office of a reservoir, and an abdominal anus established through a gridiron incision. This being done, the anus is circumcised, and the lower end of the rectum dissected out.

Armstrong (*Surg. Gynæcology and Obstetrics,* Vol. III., p. 278) enters a plea for the earlier recognition of malignant disease of the large bowel. With regard to the treatment of acute obstruction secondary to malignant disease, he points out the importance of not attempting to do more than to give relief to the most urgent symptom, obstruction.

As to the manner in which this should be done, he recommends either a short-circuiting operation, or the eventration of the affected loop, and the insertion of a Paul's tube. If the condition of the patient, and of the intestinal walls, admit of the former of these methods, the subsequent removal of the growth is greatly facilitated, and the advantages of operating through a clean abdominal wall would lead one to adopt this method where feasible. Though the eventration of the cancerous loop and its drainage through a Paul's tube is safe, the proceeding is not ideal, for, if the later excision is attempted outside the abdomen, no opportunity is afforded for the removal of the mesenteric glands, while the infected condition of the wound renders any intra-abdominal manipulation somewhat risky.

If both these procedures have to be rejected, then the distended bowel must be drained by means of a Paul's tube, or through the appendix.

For the removal of growths high up in the rectum, he favours the abdomino-perineal method, in spite of the fact that, in his experience, it generally necessitates a permanent inguinal colostomy. In the same number of *Surg. Gynæcology and Obstetrics,* Bloodgood also advocates the combined method of operating.

In order to arrive at a just estimate of the value of the abdomino-perineal method of treating growths of the rectum, it is advisable to consider the results which may be obtained without having recourse to abdominal surgery, and for this purpose, a paper by Martin du Pan (*Rev. de Chir.* 1906, Nos. 7 and 8, p. 135 *et seq.*), emanating from Kocher's clinic, will be found of great value. Although the results of the treatment of carcinoma of the rectum by the coccygeal route are extremely good, and apparently uninfluenced by the distance of the growth from the anus, yet it is worth noting that Kocher's limitation of the rectum is anatomically defined at the level of the third sacral vertebra, he thus relegates to the pelvic colon, and the resources of abdominal surgery, many tumours which might be considered, by other surgeons, worthy of attempted removal from below.

THE TREATMENT OF ULCERS.

By BERTRAM C. STEVENS, M.D., M.S. (Durh.), F.R.C.S. (Edin.),
Lancaster.

It must fall to the lot of every medical man to have an ulcer under his care. So common are ulcers, and so tedious, in many cases, is the treatment of them, that either the doctor or the patient often loses heart, and the treatment falls into abeyance before the desired result is obtained. Perhaps some antiseptic ointment or lotion is prescribed, and the patient is seen at long intervals. Now if some treatment is instituted, by means of which the patient sees some healing going on, both he and the doctor are stimulated to persevere and cure it. In order to effect this, the medical man must, metaphorically speaking, go down on his knees, and worship at that shrine of local molecular destruction, and before long he will have implanted on his brain a clear picture of the edges, base, and surrounding skin of the ulcer, and, in consequence, will logically think out the suitable treatment.

These cases require much time and attention, but the result, in most cases, justifies this, and the patient is extremely grateful. Unfortunately, there are people who still look on an ulcer as a safety outlet for the poisons in their system, and argue that, if their ulcers were healed up, others would either break out elsewhere, or they would get ill in some way or another ; and that this is a fallacy must be impressed upon them by the medical man in attendance.

In this short paper, I will only touch upon the treatment of ulcers due to local causes, omitting syphilitic, malignant, and other so-called constitutional ulcers, though brief reference will be made to tuberculous ulcers.

From the several varieties of ulcers given in text books, the energetic practitioner must do his best to reduce them to one, namely the healthy healing ulcer, and when he has succeeded thus far, he must assist nature to skin it over.

By a simple healing ulcer, I understand one in which the edges are thin and shelving, and fringed by that characteristic thin blue line of new epithelium, the base composed of small, even, red granulations, and the surrounding skin normal; the discharge serous, or mild inoffensive pus, and the ulcer itself painless and uninflamed.

The treatment then will consist in the main of two stages—

First.—Reducing the varieties of ulcers to the one simple healing ulcer.

Second.—Skinning over the simple healthy healing ulcer.

If the ulcer, which you are called upon to cure, is of the exuberant, fungous, or "proud-flesh" variety, you must begin by scraping off the excess of granulations by a curette, or by cauterising them with such applications as "blue stone," lunar caustic, or lapis divinus (mitigated caustic). After this has been done, dress the ulcer with a piece of boracic lint, cut the size of the ulcer, and dipped in a weak solution of sulphate, or chloride of zinc, *e.g.*, red lotion. Over this place a piece of oiled silk, a little absorbent wool, and a crêpe velpeau bandage. Change the dressing daily.

If the ulcer is of the weak and œdematous variety, it may be tuberculous or the result of unctuous dressings. The edges will be undermined, thick and flabby, and the base watery and sodden looking. The treatment, in this case, will have to be of a drier, and more astringent kind. A preliminary curetting may be done, or mitigated caustic applied daily, and a powder of iodoform and boracic acid in the proportion of one to two dusted on. When the ulcer has got drier, dress with red lotion of rather greater strength, and avoid the oiled silk, or other protective.

If the ulcer is inflamed, it must be rested, and warm boracic fomentations applied. In this case, chloretone, dusted lightly on, will be found useful, as it is anæsthetic and antiseptic. Weak lead lotion will be found to be a soothing dressing. The affected part should be raised and only lightly bandaged.

If the ulcer is a sloughing one, the slough must be removed, and purified by strong phenol and the application of charcoal poultices. It should be bathed several times a day with a solution of chlorinated soda (one part of liq. sodæ chlor. (B.P.) in 10 to 20 parts of water). When the ulcer is clean, antiphlogistine, spread thickly on lint, may be applied and changed daily.

If the ulcer is of the chronic, callous, or indolent variety, with hard craggy edges, a red obstinate fibrous-looking base and watery discharge, we shall have our resources taxed to the utmost to cure it. I remember one such case, of 30 years' standing, for which I could do no more than keep it clean. So extensive was it, that if the patient had been younger and stronger, one would in desperation have advised amputation of the leg.

Bad as they look, some of these ulcers can be healed, but not by simple measures. The operative treatment for such ulcers is to cut away the edges, and free the edges from the subjacent tissues, then make some radiating incisions, and try to draw the flaps together, then grafting may be tried in order to fill up the gaps and spaces left.

If not too extensive, the whole of the ulcerated area may be cut away, and grafting done.

Wallis, as reported in *British Medical Journal*, March, 1897, cured an intractable ulcer by longitudinal incisions on either side of it, then undermining the skin, freshening the edges, and bringing the freshened edges together : the fresh gaps on either side of the ulcer he then treated by grafting.

A less heroic measure is to blister the edges of the ulcer, and then strap it after dressing it with Unna's zinc glue, which consists of gelatine, glycerine, and oxide of zinc.

This variety of ulcer may, if neglected, become malignant, and erode the bone. I had a specimen of this in the tibia well shown by sawing the bone lengthways in half. The specimen is now in the Museum of the Medical School at Newcastle.

If the ulcer is of the varicose type, as in most cases it is, we have a much easier one to deal with. We know how the skin suffers from lack of nutrition, in many ways, when it contains varicose veins, and the varicose ulcer is the last result of such a loss of nutrition. Take the usual leg ulcer. Schneiderlin suggests a circular incision round the lower third of the thigh down to the muscles, then ligate all the superficial veins, and so divert the blood stream to the deeper ones. He then dresses the ulcer with a solution of acetate of aluminium.

In most cases, one should remove the superficial varicosities —and the leg must be rested, and evenly bandaged. Nearly every varicose ulcer, when first seen, requires curetting ; this can be comfortably done with a local anæsthetic, such as anestiie. After the curetting, apply for a few days warm boracic fomentations, or frequent ablutions of weak chlorinated soda solution, and, after this, dress daily with red or lead lotion, and apply an even crêpe velpeau bandage.

Thelwall Thomas advises ligation of the internal saphena vein, and resection in the groin for varicose ulcers.

We will now assume that we have reduced the ulcer to the simple healing variety. Before discussing the process of quickly skinning it over, we might turn our attention to the patient himself, and enquire into his habits and *modus vivendi.* Rest must be enforced, or at least the part under treatment must be put at rest. The diet must be light and nutritious, constipation must be avoided, and metabolism must be increased. Drugs, I should think, are very limited in number in these cases. Perhaps the *mistura alba* of most hospitals, some assimilable form of iron, and calcium chloride, or iodide, are the best.

Salts, by relieving portal engorgement, and so removing effete products, must do good. Iron, by enriching the hæmoglobin, must do good. Calcium salts, by enriching the calcium constituents of the economy, together with the alterative properties of the chlorides and iodides, have recently been found to be of much value.

With regard to calcium iodide, I have every reason to advocate its use, and have recently had two cases of ulcers, one tuberculous and the other traumatic, taking two grains of calcium iodide thrice daily with most beneficial results. Calcium chloride has a great influence in cleaning up and healing both acute and chronic ulcers, and, in cases in which it fails to complete the cure, the calcium iodide steps in and finishes the work.

For further information on this point, reference can be made to Dr. Stephens' paper in *B. M. J.*, July 21, 1906.

The Oxygen Hospital in Fitzroy Square treats ulcers by means of nascent oxygen, played upon the part. Oxygen, no doubt, has a stimulating and bactericidal effect. In the words of Mr. Burdett Coutts, "They had seen the healthy skin advancing inch by inch over those terrible areas of ulcer." Experience has shown those who employ this mode of treatment that ulcers, not doing well, are very alkaline in reaction to litmus paper, while those doing well are only faintly alkaline.

Ichthyol, 50 drops in water ℥i. fl., has been found useful in dressing ulcers.

Schulze still believes in camphor, mixed with oxide of zinc and olive oil, for leg ulcers.

Diver suggests nascent chlorine, absorbed into cotton wool, and applied to ulcers.

Veyrassat, of Geneva, recommends salt solution (7 in 1,000), used at a temperature of 50° C., as having a physiological effect on the tissues, and promoting phagocytosis. The ulcer is irrigated with the hot solution for a quarter of an hour, and a sterilised dressing then applied each day.

Orthoform has been highly spoken of in the treatment of ulcers. It is sparingly soluble, non-toxic, and powerfully antiseptic. In from 5 to 10 minutes, it produces anæsthesia of the denuded surface ; it soon reaches its height, and lasts from a few hours to 5 or 6 days.

It may be used as a 10 per cent. ointment, or as the simple powder.

Skin grafting is of course extremely useful in many cases of ulcer after it has got to the healthy healing stage. Grafting may be done either by the epithelial methods of Reverdin and Thiersch, or by the whole skin method of grafting.

I had two chief reasons for preparing this paper, one was to advocate the drug calcium iodide, to which I have briefly referred, the other is the employment of decalcified cancellous bone for speedily skinning over the healthy ulcer. It is with some remarks on this bone dressing that I will conclude.

Dr. Robinson, in the *Lancet*, 1897, suggested this cancellous tissue for healing wounds, where the edges cannot be brought together, for filling cavities either in bone or the soft parts, and for healing ulcers. I had the opportunity of working under Dr. Robinson at Huddersfield Infirmary, and there first learned the uses of this bone dressing ; one case, I remember, was that of a youth, who had part of his carpus removed for tuberculous disease, and in quite a short time the cavity was healed up and skinned over by means of this bone dressing. Arbuthnot Lane has employed it for empyema cavities with success.

The bone dressing acts by its mechanical advantages, and has no inherent virtue in itself: the fact of its being light, porous, and cancellous, enables it, when placed on a granulating surface, to fill its cells with the lymph secreted by the wound. These lymph cells then act as little beds of nourishment for the granulations, and draw on the young capillaries, and so promote healing. The method I usually employ, is to swab the wound over with cotton wool, dipped in hydrogen peroxide, and then cut up one piece of the bone into thin slices, and cover the ulcer entirely; if the ulcer is very large, one may, in order to save the bone dressing, simply apply it to the edges all round, and leave the base of the ulcer. Over the bone dressing, place a piece of boracic lint wrung out of hot water, and apply wool and a crêpe bandage. If the ulcer is very dry, oiled silk protective may be placed over the lint to keep it moist, but, if the ulcer is already moist, omit the oiled silk.

The dressings must be changed in from three to five days according to the amount of discharge from the wound. At first, the bone dressing is nearly all dissolved, but, later on, it remains clinging to the ulcers' edge, and, if you raise it, you see the thin blue line of new epithelium advancing towards the centre.

The pioneer of bone dressing is, I think, the man who began by slicing up a sponge, sprinkling it with iodoform, and strapping it on the ulcer.

I consider bone dressing a scientific, useful, and almost fascinating application in the treatment of ulcers, and open wounds generally.

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REVIEW OF DENTAL SURGERY.

By J. G. TURNER, F.R.C.S. (Eng.), L.D.S.,

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Dr. Ayrapaa, *La Laboratoire*, November 11, 1906, No. 11, p. 663, "Traitement Prosthetique des Obstructions du Pharynx," describes a vulcanite obturator, which serves to prevent reformation of adhesions when once these have been cut, and, at the same time, by providing airways through the solid rubber opening opposite healthy parts of the pharynx, allows free respiration when the parts are at rest. In speaking or swallowing, the uninjured pharyngeal muscle presses the mucosa against the obturator and blocks the airway, thus allowing normal speech and deglutition; at rest, there is a space between the obturator and these healthy parts of the naso-pharyngeal wall.

Ibid., November 25, 1906, No. 13.—Dr. R. Weiser describes the use of porcelain roots inserted into recently vacated root-sockets, as aids in the support of fixed dental bridges.

Trans. Odontological Society of Great Britain, April, 1906, Vol. 38.—Norman Bennett described the dentition of a girl of 14, whose teeth were almost entirely devoid of enamel. There was a history of infantile convulsions, and almost continuous ill-health from infancy.

Ibid., April, 1906, Vol. 38.—J. G. Turner called attention to the frequency with which abscesses and septic processes round temporary teeth lead to injury of the teeth of succession. The injury varied from a patch of ill-formed enamel to complete necrosis of the tooth, which was then cast off as a sequestrum.

Ibid., June, 1906, Vol. 38.—J. F. Colyer describes, with excellent illustrations and photographs of sections, a series of odontomes in the Museum of the Odontological Society of Great Britain. On the same subject, a descriptive catalogue of the collection of odontomes, exhibited at the British Dental Association's meeting in London in 1906, is being prepared for private circulation among subscribers.

Ibid., June, 1906, Vol. 38.—F. Lawson Dodd, in a communication on the Relation of Dental Conditions to Pulmonary Tuberculosis, calls attention to the state of the mouth in the patients seen at public sanatoriums for consumptives. On an average, 45 per cent. of the teeth were either carious or missing, and pyorrhœa alveolaris, and oral sepsis were present in about two-thirds of the patients. He was not inclined to regard a neglected mouth as a frequent source of direct infection by tubercle bacillus, but, as a bar to recovery, it was of very serious moment. He urges that, in the open-air treatment of consumption, the care of the teeth and mouth generally should be regarded as one of the most important factors making for success; and suggests that, so long as the mouths of the patients are neglected in the present manner, public money is being largely wasted in the costly institutions springing up all over the country.

This is a point which we would strongly urge on the managers of such institutions.

British Dental Journal, October 1, 1906, Vol. 27, No. 19.—Broughton Head, on "The Influence of Sex and Environment in Relation to Dental Caries and Nutrition," summarises the results of his investigations among 2,000 children of various classes—

(1) Environment appears to have no appreciable effect on the period of eruption of the permanent teeth; healthy surroundings and ample diet do not appear to accelerate the permanent dentition, neither do adverse circumstances and inadequate feeding retard it, nor is there sufficient evidence to show that the converse prevails.

(2) The influence of sex on dentition is constant in all circumstances. Precocity of dentition is exhibited by children of the female sex as contrasted with boys under similar conditions of life, in harmony with the general acceleration of growth and development that is characteristic of girls between the tenth and fifteenth years of age.

(3) Caries of the permanent teeth is progressive during the period of school age; the amount of caries is less in children living in a good environment than in those under adverse conditions.

(4) Under all conditions or environment, dental caries

tends to increase after the twelfth year in girls, as compared with boys of the same age, and to remain greater throughout the period of school life.

It is only right to say that Dr. C. Rose, of Freiburg, in his monograph "On the Decay of Teeth in the National Schools," disputes this contention. On the comparison of statistics of about 3,000 children of each sex, he states that, in his opinion, the difference between boys and girls in respect of frequency of caries is insignificant.

Ibid., April 2, 1906, Vol. 27, No. 7.—H. J. Thomas finds that the teeth of better-class school children were actually more carious than those of a lower grade, probably because the latter were forced by their parents to have their teeth out.

Ibid., December 15, 1906, Vol. 27, No. 24.—H. H. Hunter (Melbourne) describes the form of splint used for fractured mandible in the Australian College of Dentistry, Melbourne. It consists of a metal cap, swaged over a corrected model of the crowns of the lower teeth, having a metal tube, $\frac{2}{3}$rds of an inch long, soldered horizontally on to the outer side at the point of fracture. At this point, the splint is sawn in two, and each piece is cemented on to the crowns of the teeth of its proper part. When the cement is set, in about three-quarters of an hour, the fragments of the jaw are manipulated into position, and a retaining pin is forced through the divided tube.

Ibid., January 1907, Vol. 28, No. 1.—T. D. Luke, lecturer on Anæsthetics, Edinburgh University, compares local and general anæsthesia for dental work. He finds general anæsthesia preferable for longer and more difficult operations, and where certainty of anæsthesia is all important. Local anæsthetics require "faith on the patients' part," but are useful in suitable cases, and safer, where the operator is also the anæsthetist. Some form of a 10 per cent. solution of cocaine is the best local anæsthetic, and must be injected under pressure. Mr. Luke speaks highly of "gas" and ethyl-chloride, and has a higher opinion of the latter drug than have most London anæsthetists. Chloroform he condemns. He gives a most useful summary of the active agent in many proprietary and patent anæsthetic preparations.

The Dominion Dental Journal, December 1906, Vol. 18, No. 12, reports a death from ethyl-chloride, and, February 1906, Vol. 18, No. 2, one from nitrous oxide.

The Australian Journal of Dentistry, Vol. 10, No. 8, August 31, 1906, reports a case of severe hæmorrhage from the upper alveolus after tooth-extraction, which seems to have been dependent on the blood-state accompanying lympho-sarcoma.

Robertson, *Dental Review*, July 1906, Vol. 20, No. 7, "Reflex Neuroses," records two cases of bleeding from the gums, concomitant with, and possibly dependent on, menstruation. In the same paper, quoting De Witt, he mentions a case of blindness of the right eye, of 12 years standing, due to dental reflex neurosis. Shortly before the onset of the amaurosis, the patient had several teeth filled. When seen, the first right upper bicuspid was found "dead," and there was a discharging sinus over its apex. Antiseptic treatment relieved the amaurosis for a few weeks, but the sinus broke out afresh, and sight became blurred; extraction resulted in permanent cure of the amaurosis.

Robertson also notes that biliousness may be preceded by a peculiar hypersensitiveness of the teeth; and an attack of dyspepsia is, by many, more readily recognised by the uneasy sensations of the teeth than by any epigastric disturbance, in sea-sickness and sick-headache, the nausea is very frequently preceded by an intense discomfort in the teeth, and, in some cases, even extreme facial neuralgia, which disappears after emesis. He records, also, the case of a woman, of 25, in whom intractable tooth-ache was cured by treatment of the "ulcerated fundus uteri."

W. D. Miller, *Dental Review*, December, 1906, The Treat ment of Sensitive Dentine, with Special Reference to the Production of Anæsthesia by Pressure, finds from actual experiment on freshly extracted teeth that there is practically no difference in penetrating power (into dentine) of one vehicle of cocain, etc., over any other. He finds, however, that the penetration of the dentine by coloured solutions takes place under quite moderate pressure, so little as half an atmosphere, and, in this direction, is hopeful of anæsthetic results. The same author, in a communication to the Odontological Society of Great Britain, November, 1906, ascribes the causation of erosion of teeth entirely to mechanical agencies, tooth-powder, and tooth-brush. He found erosion absent among hospital patients, who never cleaned their teeth, but making its appearance in this same class with the use of the tooth-brush.

J. H. Harris, *Brit. Dent. Journ.*, November 1, 1906, Vol. 27, No. 21, describes a follicular odontome (dentigerous cyst of the jaw) from the tooth of which no Nasmyth's membrane was raised.

C. F. Bödecker, *Berlin Dental Review*, April 1906, Vol. XX., No. 4, describes a method of decalcifying tooth enamel in an acid solution of celloidin, and subsequently photographing sections by the aid of ultra-violet rays. He concludes that there is a demonstrable organic envelope to the enamel prisms.

G. V. Black, *Dental Review*, January and February 1906, Vol. XX., No. 2, "Atrophied Teeth," gives a good account of the microscopic appearances of atrophied (hypoplasic) teeth. He concludes that there are three phases.

1. An atrophy, due to a period of malnutrition, affecting those parts of several teeth at the time in process of formation. This may cause the failure of formation of all parts of the enamel and dentine in the zone involved, as seen in generally atrophied teeth.

2. An atrophy of the enamel rods, occurring in spots, as seen in pits.

3. An atrophy of the cementing substance between the enamel rods, as seen in the white spots often seen in the enamel, and in the enamel of the whole denture in rare cases (as in two cases described in the paper).

The first is clearly due to general malnutrition. The second is in part seen to occur in process of general malnutrition, but often occurs independently of this, so far as can now be discovered. The third, so far as can now be seen, depends upon some condition of nutrition as yet unknown. Specimens of this last condition, examined by Bödecker's method just mentioned, might throw light on the nature of the cementing substance and organic envelope.

In the same communication, Black calls in question the correctness of the views generally held as to the causation of Hutchinson's teeth.

NOTES FROM FOREIGN JOURNALS.

CALCIUM CHLORIDE IN CONVULSIVE NEUROSES.

The quieting effect of chloride of calcium upon the nervous system is dealt with by Netter in the *Comptes rendus, Soc. Biol.*, of March 15, 1907, who states that an excellent effect is obtained by its use in tetany, spasm of the glottis, laryngismus stridulus, and convulsions.

As regards tetany, the good results obtained do not seem open to question. One example may be quoted:—A baby, thirteen months old, was admitted into the crèche of the Hôpital Trousseau on April 20, 1906, on the sixth day of an attack of pneumonia accompanied by diarrhœa. On April 28, defervescence occurred, but there was still some diarrhœa, and the early symptoms of contractions of the limbs (carpopedal spasms) were noticed. Trousseau's symptom (increased contraction after concentric pressure of the arm) was very clearly marked. Netter prescribed 30 grains of calcium chloride on April 30. The spasms began to lessen from 4 o'clock in the afternoon, and recovery was complete by the following day. Tetany chiefly affects the young; in adults, it may be developed during lactation, after profuse diarrhœa, and after certain intoxications. In every case, probably, there is loss of lime salts; Oddo and Carle found that the urine of a child, suffering from tetany, contained an excessive amount of phosphate of lime, and Robert Quest, on the other hand, states that the brain of children, dying of tetany, contains very little calcium.

J. Loeb and some Italian writers have demonstrated the restraining influence of calcium salts upon the nervous and muscular systems. To these may be added the good effect of milk diet in tetany, which is probably due to the calcium contents. Netter has obtained equally convincing results in laryngismus stridulus and convulsions. The drug, however, has its drawbacks, for, if given in excessive doses, there is a danger of bringing about an inverse action, as the calming effect appears only to be obtained from a definite strength. Too much calcium in the blood may produce tetany, hence its appearance in children brought up on cow's milk, which contains five times more calcium than human milk. To introduce more calcium in such a case can only prove harmful by still more upsetting the balance. In practice, it is wise to be content to begin with small doses. A child of fifteen months of age was speedily relieved by a daily dose of $2\frac{1}{2}$ grains, so that a medium dose for children, of 1 to 2 years, will be between this amount and 20 to 30 grains:—

℞. Calcii Chloridi - - - - - gr. iss.
Syrup. Aurantii - - - - - ʒss.
Aq. Tiliæ - - - - - ad ʒij.
Misce. - - - - 2^{dis} vel. 3^{tiis} horis sumend.

TREATMENT OF CORYZA IN INFANTS.

In the *Journal des Praticiens* (February 23, 1907), Variot points out that simple coryza in the newly-born is a very great hindrance to suckling, and, therefore, to growth. He treats it with glycerine of boric acid (1 in 50), as he has found that the use of watery injections washes the mucous discharge backwards into the lungs, and may also produce otitis. Glycerine dehydrates the tissues, softens the dry collections, and sets them free, allowing the child to expel them by sneezing.

Adding boric acid is not indispensable, because glycerine itself is a disinfectant. A few drops are introduced into the nostrils, two or three times a day, and the most obstinate cases can be cured in this way in a few days.

BLOOD-SERUM AS A HÆMOSTATIC IN HÆMOPHILIA.

Broca, at a meeting of the *Société de Chirurgie*, read a communication from Emile Weil on this subject, giving his most recent results. Weil has proved that fresh serum—animal or human—in a dose of 3 drops per 3 c.c. of blood, promotes coagulation rather markedly in family hæmophilia, but absolutely in spontaneous hæmophilia, in which coagulation, as a rule, takes from five to ten minutes. Based upon these facts, he has drawn up some interesting surgical applications for the prevention, and even the arrest, of hæmorrhage in bleeders. Broca related several of Weil's observations, fully establishing this effect, as much preventive as curative, of fresh serum.

The practical results obtained are, that to stop hæmorrhage in an adult 10 to 20 c.c. of fresh serum injected into the veins, or 20 to 30 c.c. given hypodermically, are sufficient as a rule. In case of need, another dose may be given two days later without inconvenience. In children, half these doses will suffice. The same method is used for prevention. Serum from man, the rabbit, the horse, and the bull have all been proved to be equally effective although, *in vitro*, the action of human serum is more marked. In order to obtain a full effect, fresh serum must be used, although serum two or three months old has sometimes yielded good results. Serum from bullock's blood must never be used, as it has been found to produce serum-symptoms, always temporary, but at times intense; such as, hyperpyrexia, rigors, cyanosis, vomiting, headache, and rhachialgia. None of the other serums has caused any disturbance either at the time or subsequently.

In practice, if there is not time to wait twenty-four hours, and make an aseptic bleeding from a rabbit's carotid, recourse may be made to the anti-diphtheritic serum, which is sent out fresh each month from the Pasteur Institute; but it is preferable not to use antitoxic serums, as simple serum contains all the coagulating ferments necessary for hæmostasis.

These facts appear to provide the surgeon with a weapon of some value against a disease, in which, up to the present, he has found himself almost helpless, and, without trusting too confidently to its preventive powers, for a big, but not indispensable, operation. Broca is of opinion that, even in excessive bleeders, such operations, as for strangulated hernia, opening an abscess, or for appendicitis, may safely be undertaken. It will also be of use for stopping the loss of blood in hæmaturia. Its effect is not permanent, as the patients still remain bleeders.

BIER'S VENOUS STASIS IN ACUTE GOUT.

Alkan, in *Therapie der Gegenwart* (January 1907), recommends Bier's method of inducing venous stasis for the relief of the acute stage of gout, in view of the fact that blood-serum is the best solvent of uric acid. He reports successful results, and advises that with the hyperæmia should be associated alternately hot and cold applications locally. He removes the constricting band at the end of two or three hours, and keeps the limb elevated, applying cold compresses for two hours, and then hot fomentations. This treatment quickly puts an end to the acute attack.

RECTAL FEEDING.

BAUMGARTEN, in the *Zeitschrift für aerztl. Fortbildung*, writes on the indications for, and technique of, this method of feeding patients. The use of this device has been much extended of late years. It is used in stricture of the œsophagus, or of the cardia, until dilatation can be obtained, if the growth is not malignant. Uncontrollable vomiting, chronic gastritis, prolonged sea-sickness, etc., may render its use necessary, in order to maintain the patient's strength, and to give the alimentary canal rest. The introduction *per rectum* of water containing a small quantity of salt allows a diminution in the amount of fluid taken into the stomach, in the case of simple gastric atony, or of dilatation following pyloric stenosis, while nutritive enemata will keep up the strength of an enteric case, provided profuse diarrhœa is not present.

Each nutritive enema, three of which are usually given in the course of a day, should be preceded, one hour before, by a simple enema. The irritability of the mucous membrane can be lessened by adding 5 to 10 drops of laudanum to the enema. The patient lies on his left side, and draws his legs up towards his chest, the delivery-tube is passed in to a length of about 18 inches, and the container is held 3 feet above the level of the bed.

Fats are assimilated very slowly, even with the addition of pancreatine and similar preparations; a little bi-carbonate of soda should always be added to the enema to make it slightly alkaline. Carbo-hydrates are better absorbed, but sugar must not be used in concentrated solution, not more than 10 to 20 per cent. Starch, 1½ to 2½ ounces in 8 ounces of water, is very useful. The question of albuminoids is difficult; milk, and also eggs, are always easy to give. Peptones, 2 to 3 ounces in 8 to 10 ounces of water, do not irritate the rectum, and are easily absorbed; they are preferred by modern practitioners to milk and eggs, as these are liable to fermentations, which give rise to irritation in the rectum. Peptones have the disadvantage of being costly.

Meat, even with the addition of pancreas, as recommended by Leube, is not very suitable, but may be used in combination with other foods. Much improvement has resulted since Bial pointed out that the addition of equal parts of alcohol to peptones facilitated absorption. A useful formula is:—

Dry peptone.	
Sugar of Milk - - - - -	1 ounce of each.
Alcohol - - - - -	1 ounce.
Tincture of Opium - - - -	10 drops.
Water, to make - - - -	9 ounces.

Nutrient enemata can only be used for a short time, as the irritability of the mucous membrane always increases.

FOR IRRITATION OF THE GUMS IN BABIES.

Le Gendre recommends the use of the following :—

℞. Potass. Bromidi - - - - gr. xv.
Sodii Boratis - - - - - gr. xxx.
Tinct. Croci - - - - - ♏v.
Glycerini.
Aq. - - - - - - āā ʒiv.

"To be rubbed over the gums."

TREATMENT OF ERYTHEMA OF THE BUTTOCKS IN INFANTS.

Quillier, in the February number of the *Revue pratique de Gynécologie, d'Obstétrique, et de Pédiatrie*, writes on this subject, pointing out that as this affection, when left to itself, or when insufficiently treated, gets much worse, and becomes vesicular, papular, or even ulcerous, early and proper treatment is necessary.

Much of it is due to irritation by the excreta, and this irritation is much increased when the digestive system is out of order. The regular and proper feeding of the child, whether by breast or bottle, must be insisted upon, and, in the greater number of cases, this is sufficient to cure the dermatitis as well as the indigestion.

For local treatment, cleanliness, and hygienic attention are prophylactics. In the vesicular and papular forms, care must be taken that the child is not always kept on its back, or its buttocks. It must be turned over frequently, and even put to bed lying on its stomach, in order to avoid too prolonged compression of the back parts.

In erythema of any description, the use of the bath must be prohibited, for even if of plain boiled water, or mildly antiseptic, the bath, however short, does more harm than good. It is much better, each time the child requires cleansing, to wash the parts carefully and gently with absorbent wool and warm boiled water, then to sponge, and finally to powder over with :—

℞. Zinci Oxydi - - - - - ℥i.
Bismuthi Subnit.
Talci - - - - - - - āā ℥ij.

Misce. Fiat pulvis.

In mild cases, it is wise to withhold ointments, for vaseline, even when pure and sterilised, may be irritating. In ulcerative and papular cases, Quillier trusts almost entirely to glycerine of starch, which prevents friction, and yields good results. In every case, prophylaxis must be given the first place, local treatment being but an adjuvant.

FOR ANAL FISSURE.

The *Journal de Médecine de Paris* gives a prescription recommended by Katzenstein for use in this affection, when operation is inconvenient or refused :—

℞. Cocain. Hydrochlor.
Ext. Belladonnæ - - - - āā gr. i.
Ichthyol - - - - - - ʒiss.

"Mix with hot water and apply."

MUTTON-FAT AS A BASIS FOR PILLS.

Mutton-fat, purified, and melting at 45° C., is not acted upon by the gastric juice, and can, therefore, be used as the basis for pills containing substances, whose action it is wished to obtain only in the intestines. When the pills are made up, they should be rolled in calcined magnesia to get a coating. (*Journal de Médecine de Paris.*)

TREATMENT OF CONVULSIONS IN CHILDREN.

Weile insists on the avoidance of all cerebral excitement and errors in diet, and on the treatment of constipation, worms, etc. When febrile symptoms are present, use must be made of the wet pack, hot or cold baths, or ice to the head. The treatment of the actual convulsive attack consists of inhalations of chloroform, always provided that there is no indigestion. Children, even of the youngest age, tolerate chloroform remarkably well, and it is far preferable than ether for them. A few drops are sprinkled on a handkerchief, and, after taking a few breaths, the child becomes less violently convulsed. The administration must be kept up until the fits cease altogether, but should be suspended during the quiet intervals. Prolonged warm baths are equally useful, but require to be kept up for one or two hours. Injections of artificial serum, 25 to 50 c.c. for a dose, two or three times a day, have sometimes given good results. Weile more particularly recommends these in eclampsia with high temperature, dry mucous membranes, dysuria, and sluggish peripheral circulation. Inhalations of oxygen are required in asphyxial convulsions.

In order to prevent the return of the fits, chloral or bromide must be given. Chloral acts very quickly; a new-born infant may be given ½ to ¾ grain; a babe of a few months may have ¾ to 2 grains, and these doses may be repeated up to four or five times a day. If given in an enema, the dose must be doubled. Bromide can be given in larger doses, 15, 30, or even 45 grains a day. Weile has never seen any bad effects arise from these.—(*Revue intern. de Méd. et de Chirurgie.*)

TREATMENT OF GASTRIC ULCERS.

Bourget, of Lausanne, in his *Maladies de l'estomac et traitement*, advises :—

1st. Washing out the stomach with 1 per 1,000 solution of perchloride of iron, using about 3½ ozs. at a time, and withdrawing the fluid. The pain and bleeding will be stopped by these.

2nd. Treatment by alkalies.—It is not necessary to neutralise the contents of the stomach, but the amount of acidity must be reduced. The following is useful :—

℞ Sodii Bicarb. - - - - - - - ʒijs.
Sodii Phosph. Exsicc.
Sodii Sulph. Exsicc. - - - - āā ʒss.
Misce. Mitte tales No. x.

One to be dissolved in 2 pints of water, and to this should be added ʒj. of fluid extract of condurango. Ten to 15 ounces of this alkaline water are to be taken in the 24 hours, about 5 ounces at a time, if the pylorus is permeable; if it is not, it must be taken in doses of 1 ounce.

3rd. Feeding.—The stomach does not need to be kept completely at rest, but must have liquid food. Milk is best, not plain, but thickened with rice, tapioca, or semolina. After five days, the patient is allowed eggs, pastes, potato purée made with milk, cream, etc. On the fifteenth day, the diet is increased to white meat, jellies, cooked fruit and vegetables. The use of the alkaline water in small doses between meals must be continued for five or six weeks.

TREATMENT OF TIC DOULOUREUX, SCIATICA, AND NEURALGIA OF ZONA.

ALBERT ROBIN considers that, in actual practice, more may be done by combination of drugs to relieve the pain in obstinate cases of tic than by giving analgesics singly.

The use of the following prescriptions will after a time bring relief to patients :—

℞.	Pyramidon	gr. jss.
	Phenacetin	gr. iv.
	Exalgin	gr. jss.
	Pulv. Doveri (sine Ipecac.)	gr. iij.

Misce. Fiat pulv. j. Cap. j in cachet. 2 vel. 3 quotidie.

If the effect gets exhausted, this syrup may be given instead :—

℞.	Pyramidon	ʒjss.
	Ammon. Bromidi,	
	Ammon. Iodidi	āā ʒiij.
	Spartein. Sulph.	
	Cocain. Hydrochlor.	āā gr. iij.
	Caffein. Valerianat.	gr. xv.
	Syrup. Aurantii.	℥vj.

Misce. Ft. Mist., cap. ℥ss ter quotidie.

For local treatment, he recommends the daily injection of 1 c.c. (17 minims) of a 25 per cent. solution of glycero-phosphate of soda, into the sub-orbital nerve at its point of exit. If, after eight injections, no effect has been produced, injections of scopolamine hydrobromate must be given *loco dolenti*, beginning with $\frac{1}{10}$th of a milligramme (gr. $\frac{1}{650}$th), and gradually increasing to $\frac{1}{2}$ mg. ($\frac{1}{120}$th of gr.). Finally, aconitine may be injected, beginning with the same dose as scopolamine, but not going beyond $\frac{3}{10}$ths of a mg. Concurrently with this, the painful parts and the back of the neck should be sprayed with ether twice a day.

For general treatment, he gives powdered cinchona bark, using a mixture of the grey, red, and yellow in equal parts, of which 2 to 4 doses of 15 grs. are given in a cup of coffee after each meal during the day. Should this treatment upset the stomach, it is replaced by pills containing :—

℞.	Potass. Iodidi	gr. jss.
	Acid. Arsenios.	gr. $\frac{1}{64}$.
	Pulv. Rhei	gr. $\frac{3}{4}$.
	Ext. Dulcamaræ.	gr. jss.

Misce. Ft. pil. j. ter die sumend. c̄. cibo.

If this treatment fails, electricity, applied by a specialist, must be tried, and, finally, operative treatment may be necessary.

Injections of glycero-phosphate of soda give good results in different neuralgias, notably in sciatica.

For zona, the best course is to dry up the vesicles to prevent infection, using:—

℞.	Zinci Peroxyd.	gr. xxx.
	Pulv. Camphor.	℥ss.
	Amyli	℥ij.

M. Ft. pulv.

"Use freely over the parts affected."

To allay the subsequent pains, it is, as a rule, sufficient to give these pills:—

℞.	Ext. Stramonii.	
	Ext. Belladonnæ.	
	Ext. Hyoscyami	āā gr. $\frac{1}{6}$.

Misce. Fiat. pil. j.

"One to be taken in the evening, and another at bedtime."

In the case of obstinate neuralgias, injections of glycero-phosphate of soda should be made at the most painful spots, using scopolamine hydrobromate in more obstinate cases.—(*Bulletin Gén. de Thérapeutique.*)

THE USE OF TANNIN IN TOOTH AFFECTIONS.

Max Kner, in the *Wiener Med. Presse*, states that he has often noticed, in pyorrhœa alveolaris, pains similar to neuralgia, or rheumatism, attacking one or more teeth, and resisting all attempts at relief. The patient frequently clamours for the removal of the tooth. Kner, in such cases, uses a concentrated alcoholic solution of tannin:—

℞.	Tannin	gr. xxx.
	Sp. Vini Rect.	ʒijss.

With this solution he bathes, by means of a swab of absorbent wool soaked therein, the whole of the side affected along the border of the gums, and then allows the patient to repeat this procedure if the pains return. After this bathing, the pain quite disappears, and the pyorrhœa clearsmore quickly and easily under the influence of tannin than with nitrate of silver and other means. while loose teeth are tightened in their sockets.

CURE OF WRITER'S CRAMP BY BIER'S METHOD.

Hartenberg reports, in the *Archives de Neurologie*, his experiences of the method of the elastic ligature in muscular disorders, such as contractions, spasms, cramps, and so forth. Without drawing general conclusions, he believes in the excellence of the method, and cites, by way of example, the remarkable result obtained in a case of writer's cramp. The patient was a clerk, aged 37 years, and had suffered for 15 years. His writing was almost illegible, especially towards the end of the day, and became impossible under stress of anxiety. During the 15 years, he had alternate periods of slight improvement and aggravation. His general health was good, and he was a big, strong man, although nervous and impressionable. Every possible method of treatment had been tried without the least success. In 1905, Hartenberg saw the case, and advised the use of the elastic ligature, a treatment which the patient could carry out himself at home in the depth of the country. It consisted in simply tying a rubber-tube round the arm above the biceps for 20 minutes, morning and evening, so as to produce the stasis, recommended by Bier. After 15 days, the patient wrote to express his gratitude for the relief obtained, and, two months later, wrote again to say he was completely cured.

Reviews of Books.

NOTES ON NEW EDITIONS.

A Handbook of the Diseases of the Eye and their Treatment. By Sir HENRY R. SWANZY, A.M., M.D., and LOUIS WERNER, M.B., F.R.C.S.I. Pp. 744. Illustrated. London: H. K. Lewis. 12s. 6d.

THE ninth edition of this excellent book is very welcome. It now appears under joint authorship, and by this arrangement, the value of the work has been increased. Obsolete matter has been discarded, and much that is new has been added, which includes an excellent chapter on elementary optics. The size of the book has been slightly increased, which is mainly due to the fact that more than sixty excellent illustrations have been added. It is an essentially practical work, and one of the best extant on Ophthalmology.

The Refraction of the Eye. By GUSTAVUS HARTRIDGE, F.R.C.S., Senior Surgeon to the Royal Westminster Ophthalmic Hospital; Ophthalmic Surgeon and Lecturer on Ophthalmic Surgery to the Westminster Hospital, etc., etc. Pp. 273. London: J. and A. Churchill. 5s. net.

THE fact that this book has gone through thirteen editions, since 1884, is sufficient evidence of its utility and popularity. The present—the fourteenth—edition has been carefully revised and a few alterations have been made. It contains 109 illustrations, all of which are exceedingly well reproduced. The book has been specially written for students, and we can strongly recommend it.

Refraction of the Eye, its Diagnosis and the Correction of its Errors, with a Chapter on the Use of Prisms. By A. STANFORD MORTON, M.B., F.R.C.S. Pp. 96. London: H. K. Lewis. 3s. 6d.

THIS book, which has now reached its seventh edition, is one of the most useful and most practical that we know of dealing with the refraction of the eye. Its value has been enhanced by the short chapter upon the use of prisms, which appears for the first time. We can confidently recommend the book to all those who are commencing the study of ophthalmology.

The Ophthalmoscope; A Manual for Students. By GUSTAVUS HARTRIDGE, F.R.C.S., Surgeon to the Royal Westminster Ophthalmic Hospital, Ophthalmic Surgeon and Lecturer on Ophthalmic Surgery to the Westminster Hospital, etc. Pp. 147. London: J. and A. Churchill. 4s. net.

THE fifth edition of Mr. Hartridge's book is very welcome, as it is undoubtedly one of the best and most practical works upon the subject with which it deals. It has been carefully revised, and a few necessary additions included. There are sixty-eight illustrations, and four good plates, which serve to render perfectly clear the various conditions of the fundus oculi.

Anæsthetics and their Administration. By FREDERIC W. HEWITT, M.V.O., M.A., M.D. Third edition. Pp. 627. London: Macmillan & Co., Ltd. 15s.

IT is six years since the last edition of Dr. Hewitt's well-known book was issued to the profession, and the additional work, in connection with anæsthetics, that has been done during that time, renders a new edition, with an increase of a hundred pages, necessary. An entirely new chapter, for example, is now devoted to "Ethyl Chloride," of which drug, however, the author appears to be no enthusiastic employer. This book has always been admirable for the fair, and, at the same time, concise manner in which the investigations of other observers in his own field are summarised by Dr. Hewitt. This excellent quality is again conspicuous in the edition before us, and we think that no work of any importance, in connection with anæsthesia, at any rate in Great Britain, has been left unnoticed. Thus Dr. Hewitt's book, if rather large for the average practitioner, is a book of reference of the greatest possible value to any who are especially engaged upon anæsthetic work. Moreover, the author's skill and career as a practical anæsthetist lend great weight to the directions conveyed in his book.

Anæsthetics: their Uses and Administration. By DUDLEY WILMOT BUXTON, M.D., B.S.; Member of the Royal College of Physicians; sometime President of the Society of Anæsthetists; Administrator of Anæsthetics and Lecturer in University College Hospital, etc. Fourth edition. Pp. viii and 415. Frontispiece and 62 illustrations. Crown 8vo. London: H. K. Lewis. 7s. 6d.

THE fourth edition of this well-known work will be welcomed by every one who wishes to have first-hand information on this most important subject from one who is so completely a master of it as Dr. Dudley Buxton is. The book contains fresh articles dealing with dosimetry in chloroform, the use of ethyl chloride as a general anæsthetic, and the production of anæsthesia by spinal injection. In addition to these, much of the book has been re-written, and now includes some account of recent scientific research upon anæsthetics. As Dr. Buxton has been one of the foremost in putting this extremely important matter, by means of accurate experimental research, upon a proper scientific footing, in place of its former purely empirical basis, he is entitled to speak with authority, but, nevertheless, he is never dogmatic. The rules laid down and the practical suggestions given are always very clear, definite, and concise, and for each he supplies the duly ascertained reason. This, it seems to us, is one of the features which make the book of such great value to every practitioner, upon whom, nowadays, it is incumbent that he shall be a capable and trustworthy anæsthetist. We are sure that we cannot too strongly commend this most excellent work to practitioners, for it is as full of meat as is the proverbial egg, and contains the latest information of value.

The Nature, Causes, Ætiology and Treatment of Bodily Deformities, in a series of lectures. By the late E. J. CHANCE, F.R.C.S., England.

Edited by John Poland, F.R.C.S., England; Surgeon to the City Orthopædic Hospital and Senior Surgeon to the Miller Hospital. Second edition, in two volumes. Small octavo. 299 pp. 117 illustrations. London: Smith, Elder & Co.

In this, the second edition of the first of the two volumes of Mr. Chance's Lectures on Bodily Deformities, now re-edited by Mr. John Poland, we find fully discussed many interesting topics concerning the genesis of human malformations. Few surgeons have had so many opportunities as the late Mr. Chance of seeing such cases, and few have brought to the study of the subject so keen an insight into the salient facts, and have been able to deduce so effectually the lessons to be learnt. Mr. Chance appears to have been a most careful taker of notes, and there is ample evidence in the volume to show that he was an artist of no mean merit, for he himself made all the drawings on the wood that appear under his initials.

Mr. Poland, as we should expect of him, has most carefully performed his task. He has, in some cases, omitted several obsolete tables and notes, but has added greatly to the value of the book by apposite notes of his own. The Introduction is interesting reading, and Mr. Chance pleads strongly for specialisation in medical and surgical practice. Perhaps he did not foresee the extent to which modern specialism would go, but he must have recognised that, in his day, the field was becoming so wide that no surgeon could cover it efficiently. The first lecture is occupied by a physiological disquisition on the nature of deformities, under the headings of the period of acquisition, the entity operated upon by the inducing cause, and the types of deviation produced. The remaining five lectures are devoted to the discussion of the inducing cause; and physiology, both animal and vegetable, embryology, and the doctrine of heredity, are used to point the arguments. The chief interest circles around the question as to whether the position *in utero* is or is not the cause of many congenital deformities. The exciting causes of acquired deformities are dealt with in the last two lectures.

Although the work proceeds from one who upheld the claims of specialism in particular branches of surgery, yet so comprehensive is the knowledge, so wide is the spirit of research displayed, and such a thorough grasp of the anatomy and of the physiology of that day is shown, that, as the *Lancet* remarked in the review of the first edition, "It is a book that has so little of the narrow spirit of the specialist in it as is rarely seen."

On Diseases of the Rectum and Anus. By Harrison Cripps, F.R.C.S., Senior Surgeon, St. Bartholomew's Hospital, Member of the Council, Royal College of Surgeons, etc. Pp. 588; 13 plates. London: J. and A. Churchill. 10s. 6d. net.

Practitioners will welcome the third edition of this practical work, which has been revised and brought up to date. It includes the fifth edition of the Jacksonian Prize Essay on Cancer. The chapters dealing with cancer of the rectum have been rewritten, and, in order to increase the usefulness of the book, Mr. Harrison Cripps has added a table of 380 consecutive cases of rectal cancer, which have occurred in his private practice, with an analysis of the results obtained from excision and colotomy.

Organic and Functional Nervous Diseases. By M. ALLEN STARR, M.D., PH.D., LL.D., Sc.D., Professor of Neurology, College of Physicians and Surgeons, the Medical Department of Columbia University, in the City of New York, etc. Pp. 816; illustrated with 282 engravings in the text, and 26 plates in colours and monochrome. London Baillière, Tindall, and Cox. 5s. net.

IN this, the second, edition of Professor Allen Starr's book, the author has carefully revised the section dealing with organic diseases of the nervous system, and much new material has been added. A new section dealing with the functional diseases has also been included. The work is essentially practical, for although the ætiology and symptoms of the diseases have received full attention, the author has considered very carefully the necessary treatment in detail. A special word must be added in praise of the illustrations and figures, which are all excellent and clear.

The Essentials of Histology, Descriptive and Practical. By E. A. SCHÄFER, LL.D., D.Sc., F.R.S., Professor of Physiology in the University of Edinburgh. Pp. 507. London: Longmans, Green & Co. 10s. 6d. net.

PROFESSOR SCHÄFER'S well-known and much used book, *The Essentials of Histology*, has now reached the seventh edition. This edition has been very considerably enlarged through the inclusion of descriptive matter in the text, especially dealing with the central nervous system, and also a number of new illustrations, some of which have been taken from Professor Ramón Cajal's original drawings. Many of the illustrations in the book are for the first time printed in colour. Every medical student should possess a copy of this work.

Experiments on Animals. By STEPHEN PAGET, with an Introduction by Lord LISTER. Third and revised edition. Pp. xii + 387. London: Nisbet & Co., Ltd. 4s. 6d. net.

THE busy practitioner, at times, and especially at times when the anti-vivisector is on the war-path, as at present, is not always able, on the spur of the moment, to adduce chapter and verse in support of some point in this acute controversy, or to bring rebutting evidence to show the absurdity and baselessness of some or other barefaced statement, noisily alleged to be fact. The appearance of a new edition of Mr. Stephen Paget's excellent book, which has been, so far as possible, carefully brought up to date, is exceedingly well-timed and greatly to be welcomed, So long as this fanaticism of philozoic sentiment, as Huxley dubbed it, is rampant, a medical man must be prepared to speak fearlessly with the enemy in the gate, armed *cap-à-pie*, and thus be able to destroy those weapons of subtle lies "which are half the truth," with which his armoury is so abundantly supplied, and which are the "harder matter to fight." For this purpose, Mr. Paget's book is most admirably suited, and we most strongly recommend every medical man to find a place on his book-shelves for a copy

Röntgen Rays in Medical Work. By DAVID WALSH, M.D. 4th edition. Pp. 443. London: Baillière, Tindall, and Cox. 15s. net.

THIS book will prove of value to those for whom it appears to have been written, to the general surgeon, or physician, and to the beginners in X-ray work, although its perusal will also repay the expert. Part I., by Dr. Lewis Jones, treats of the necessary electrical apparatus in a very practical manner, and gives much useful advice on the use of the electric mains, and the various methods of localising. Part II. deals with the application of the Rays to medical and surgical work, and is well illustrated. The consideration of foreign bodies and of fractures necessarily takes up a considerable portion of this part of the book; difficulties in localising are explained, and causes of distortions and of errors pointed out. In the section devoted to medicine are described means of diagnosis, and the various therapeutic applications of the Rays in use at the present time. There are also chapters on obstetrics, legal medicine, anatomy, and physiology.

Massage and the Swedish Movements. By K. W. OSTROM. Pp. x and 184. Cr. 8vo. London: H. K. LEWIS. 3s. 6d. net.

THAT this book has proved its usefulness is shown by the fact that it has reached its sixth edition. The author defines massage as a scientific treatment by certain passive systematic manipulations upon the nude skin of the human body, and Swedish movements, as a series of systematic exercises therapeutically applied to the human body. For full details concerning these various manipulations and movements, as well as their application to the various diseases of the body, the reader cannot have a better guide than this small manual of Ostrom's. One hundred and fifteen realistic illustrations add to the usefulness of the volume, which, for type and general get-up, leaves nothing to be desired.

Diseases of Women; A Clinical Guide to their Diagnosis and Treatment. By GEORGE ERNEST HERMAN, M.B. (Lond.), F.R.C.P., Consulting Obstetric Physician to the London Hospital, etc. Pp. 900. 265 illustrations. London: Cassell & Co., Limited. 25s.

FOR many years past, Dr. Herman's book on the diseases peculiar to women has been considered to be one of the standard works upon that subject in the English language. Students and practitioners alike will welcome this, the third edition, which has been revised throughout. There is a full and lucid account of chorion-epithelioma, and the result of the investigations on the nature of urethral caruncles, by Drs. Herbert Williamson and Atlee, has been included. Every general practitioner will do well to secure a copy of this important work.

Materia Medica, Pharmacy, Pharmacology, and Therapeutics. By W. HALE WHITE, M.D., F.R.C.P., Physician to and Lecturer on Medicine at Guy's Hospital, etc. Pp. 692. London: J. and A. Churchill. 6s. 6d. net.

DR. HALE WHITE's book is one of the best of its kind, and the fact that it has already gone through nine editions, since 1892, is a sufficient proof of its usefulness. The present, the tenth, edition has been very carefully gone through and brought up to date. There are two good sections upon serums and vaccines which, at the present time, are exceedingly useful. The book will be found to be of great advantage to the general practitioner, as well as to the medical student.

A Handbook of Climatic Treatment, including Balneology. By W. R. Huggard, M.D., F.R.C.P. London: Macmillan & Co. 12s. 6d.

This book is a comprehensive monograph on climatic treatment by a well-qualified expert. It is written in a straightforward, impartial fashion, the facts are well arranged, while the statistical tables are not, as a rule, too formidable for comprehension. Dr. Huggard introduces his subject by a scientific expository of the various meteorological influences which determine the nature of a climate, and discusses their effect on the individual. Discarding the older and unsatisfactory classifications of climate, the author bases his system on the demand made by climate for the production of heat by tissue-change. He emphasises the importance of studying the reaction of each patient in this respect, since that forms the only safe guide to climatic treatment.

A concise account of the chief health resorts is added, in which the advantages and drawbacks of each are ably summarised. Mineral waters are, as usual, dealt with according to their characters and uses. In the final section of therapeutics, the whole subject is described in its application to each form of disease.

Military Hygiene. By R. Caldwell, F.R.C.S., D.P.H., Lieut.-Colonel R.A.M.C. Demy 8vo. Pages xii + 416. Illustrations, 52. London: Baillière, Tindall, and Cox. 10s. 6d. net.

The author is careful to explain that this book is written in the hope that it may be "acceptable to officers of the army in general, as well as to officers of the medical services." To write a work that shall be suitable at once for the professional and non-professional reader is never an easy task, but Col. Caldwell seems to have succeeded very well.

The early chapters deal with the epidemic diseases to which troops on service are most liable. Then subjects, such as Water, Food, and Climate, are treated in a simple manner, and considerable attention is given to the important matter of "Refuse Disposal" in military camps, at home and abroad. There are some common-sense remarks on Alcohol, and also useful information on "Sick Transport," "Equipment," "Routine Duties," "Disinfection," etc.

The illustrations, if not always very instructive to the student of hygiene, are, at any rate, interesting; and there are numerous quotations from authoritative sources.

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Notes by the Way.

The Pharisees of Science.

Of the gospel of immunisation we need only say that it is a dream, which, however beautiful, is still very far from fulfilment. It cannot be denied, however, that, even in its present inchoate stage of evolution, it has certain advantages. The pity is that so far, while its benefits are positive from the practitioner's point of view, they are often more or less problematic from that of the patient. But it cannot be said that the temper of mind to which the system gives rise in those who follow—or perhaps it might be more correct to say which gives rise to the system—is one that makes for the progress of practical medicine, that is to say, for the deliverance of mankind from the majority of the ailments from which it suffers. The Pharisee of science looks down on the mere physician or surgeon, giving thanks that he is not even as this publican of practice. Yet what the people ask for is the bread of cure, or, at any rate, relief, and from the laboratory they too often get a stone, occasionally even a serpent.

* * * * *

The Sun on the Surgery Shelf.

As for the other prophet, who foretells that the medicine bottles on surgery shelves will be replaced by sunlight and fresh air, the practitioner will probably be inclined to ask where he can get a sufficient and constant supply of these valuable therapeutic agents. The wholesale prescription of these things to poor folk "in populous city pent" is as "extraordinary" as any of those of the ancient doctor who is made the object of cheap ridicule. "Simple living" is by no means easy, except to rich people who have nothing else to do; and that otiose phrase "suitable diet" must sound like a bitter jest to poor starving folk who have to feed themselves and their children on what they can get—too often out of the gutter.

* * * * *

"High Jinks" and Hygiene.

Readers of *Guy Mannering* will remember the convivial exercises, known as "High Jinks," indulged in by old-time Edinburgh lawyers. We are inclined to think that the President of the Royal Institute of Public Health must have been playing such a part at Douglas as that in which Counsellor Pleydell was found performing by Colonel Mannering. Some such idea, we take it, inspired Sir Charles Cameron in his description of Sir James Barr as a combination of Oliver Wendell Holmes and Mark Twain. At any rate, while we fully agree with Sir Charles that there was much sound philosophy in the President's paper, it is undeniable that it was relieved by a good deal of comedy. Sir James Barr seems to reverse the Biblical precept, and to hold that people should honour the physician for the fact that they have no need of him. The notion that they will make a practice of going to him to be "overhauled," when they are not ill, is distinctly comic. If they did, no doubt, the "latent germs of disease" (to use a happy phrase of a physician of a bygone day who practised Sir James Barr's system with much success) would sometimes be discovered; but, on the other hand, what an introspective and hysterical race would be produced! We should always be, like Herbert Spencer, feeling our pulse. This tendency is already too common among the present generation. We cannot see how Sir James Barr reconciles such advice with his ideal of "muscular Christianity," a principal element of which is a somewhat boastful defiance of the doctor's precepts, which are naturally framed for weaklings; he would apparently wish to see the weaklings, or, as he calls them, the pygmies, eliminated. In regard to this, we venture to say to him what the King, then Prince of Wales, is reported to have said to an eminent journalist, "You are too strenuous." Sir James, indeed, is strenuous to the verge of ferocity in his contempt of "pygmies." He forgets that it is only by "pygmies" that much of the best work has been done in the service of man. St. Paul, on his own showing, was a pygmy: Aristotle was a pygmy: Laplace was a pygmy; Nelson, Wellington, and Napoleon were pygmies. In our own profession, such pygmies as William Harvey, John Hunter, Laënnec, and Syme have left a record which even the President of the Institute of

Public Health might envy. Oliver Wendell Holmes, who has been honoured by comparison with Sir James Barr, himself was a pygmy. The truth is, that, as was pointed out by Huxley, "Survival of the Fittest" by no means implies survival of the best. The attempt to improve the stock by eliminating pygmies would probably have no better result even in the physical order than that of Frederick the Great's father to "propagate procerity."

* * * * *

The Limits of Prevention.

It is all very well for a physician to scoff at surgery, and to say that if people went early enough to the physician all would be for the best in the best of all possible worlds. But alas! of how many so-called preventable diseases must still be said, "If preventable, why not prevented?" And leaving infectious diseases out of reckoning, how much can be done for the prevention of cancer, rheumatoid arthritis, enlarged prostate, and other conditions that are directly fatal, or make the life of the sufferer an almost intolerable burden? Sir James Barr says that diseases of the heart, blood vessels, and kidneys are on the increase, and he attributes this, no doubt correctly, to greater wear and tear, worry, and anxiety in life. He sees in these affections wide scope for preventive medicine. But how is the physician to prevent worry? Here it must be owned that the Christian Scientist, with all his ineptitudes, has the better of us, for in those, who believe in him, he actually does prevent worry.

We have often insisted on the duty of the profession to educate the public. But the fashion, which seems to be growing, of representatives of medical science mounting the platform only to tickle the ears of the groundlings, is likely to mislead rather than to instruct.

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The Physical Characters of the Insane.

Mr. J. F. Tocher, of Peterhead, who has made a special study of physical anthropology for many years, and who is known by some interesting anthropometric work, has recently published a survey of the physical characters of the insane in Scotland. The idea originated with Dr. Macpherson, one of the Commissioners in Lunacy for Scotland. The results have recently been published in the form of a Report, which is reprinted as a supplement to Volume V. of *Biometrika*, Part 3, February 1907. It, therefore, comes before the scientific public with the *Imprimatur*, Professor Karl Pearson, who, as is well known, has for some time past been directing a series of researches, which, it is hoped, will deprive the cynical classification, "Lies, d—d lies, and statistics," of whatever point it possessed.

In all, Mr. Tocher and his assistants made their observations on 4,436 males and 3,951 females, but from these numbers 55 males and 26 females were excluded from the general analysis, because they were suffering from some congenital defect, such as idiocy, rickets, syphilis, or tuberculosis, in such manner as to directly affect their anthropometric characters.

There were accordingly left 4,381 males and 3,925 females, who were taken to represent the ordinary, normal asylum, or general insane population, *i.e.*, those mentally affected, exclusive of the specific cases just mentioned. None but adults were included in the analysis, which it took Mr. Tocher three years to prepare.

The investigation has brought out some interesting facts, though the full significance of these is not yet apparent. Thus, the mean stature of the Scottish insane is distinctly less than that of the sane population in any of the districts measured.

* * * * *

Blue Eyes and Madness.

AGAIN, in respect to the colour of the hair and eyes, there is a material difference between the people in general and the insane. Generally speaking, Scottish lunatics have lighter coloured eyes and darker coloured hair than the bulk of their fellow countrymen. This seems to show that there is a greater tendency to insanity among persons presenting these physical characters. Red hair and dark eyes are less frequently associated with insanity.

While the general colour distributions of the insane differ significantly, in some respects, from those of the adult sane population, the colour distribution of the insane throughout

Scotland is by no means uniform. Generally speaking, the north of Scotland is a region of excess of dark and red hair and medium eyes; the south-west of medium hair; and the south, of light eyes. The country, lying directly between the Firth of Forth and Firth of Clyde, has an excess of fair hair as well as of dark eyes; and the Montrose group, which includes Caithness and Shetland as well as Kincardine and North Forfar, has also an excess of fair hair in the male population.

The connection between the absence of pigment in the iris, and, in a less degree, the presence of it in the hair, is a problem that may be commended to the attention of assistant medical officers of asylums as a recreative diversion from their normal work of lawn tennis and private theatricals. Another variation from the normal type in the insane is that, in the Aberdeen district at any rate, the sane population is broader in the head and greater in stature. Local populations differ from each other sensibly in many respects.

Thus, the population of the south-west of Scotland, exclusive of Glasgow, is long-headed or macrocranial, that of the north-west is short-headed or brachycranial. The people in the north of Scotland are broad-headed or platycranial. In Glasgow, Edinburgh, and the populous centres round them, they are stenocranial or narrow-headed. Again, in the north of Scotland the population is distinctly brachycephalic, while in the south-west, it is distinctly dolichocephalic. In the large towns (excepting Edinburgh, where it approximates to the mean) the population is microcephalic or small-headed. In the Scottish Midlands, excluding towns, it is macrocephalic or large-headed. In the rest of the country the population approximates to the average size, and is mesocephalic. In head height, there are two sharply divided groups, a high-headed group in the Midlands, and a low-headed one. In the border counties the inhabitants are tall of stature. In the towns generally, the population is decidedly shorter.

* * * * *

General Conclusions.

Mr. Tocher's investigations, so far as they go, tend to show that (*a*) the insane are, on an average, probably shorter than the sane; (*b*) there is a distinct difference in type between the class, or race material, from which the insane and the criminals are drawn, the criminals being larger-headed and shorter men on an average than the insane. If the criminals and the insane belonged to the same race, or contained proportionally the same racial elements, it would be clear that the criminals were drawn from a physically different section of the community. About 35 per cent. of the habitual criminals in Scotland, however, are of Irish extraction, and the problem, thus complicated, cannot be solved without a knowledge of the physical characters of both races. Incidentally, the criminals differ little among themselves. They are a homogeneous group, excepting that those, convicted of murder and assault, have significantly longer heads than the others. So far as can be judged, if head and skull measurements are compared, there is little difference between the asylum population and Turner's Scottish cranial series.

We hope that a similar painstaking examination of the physical characters of the insane, in other parts of the United Kingdom, may be undertaken by an equally competent investigator.

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Notice. ALL original articles intended for publication should be addressed to the Editor, and not to any individual.

Practical Notes.

TRYPSIN.—The pancreas is a tubulo-racemose gland very closely resembling the salivary glands in structure. The secreting cells, which line the acini of the pancreas, are cubical, or polyhedral in shape. If these are examined in the fresh condition, and, particularly, if the acini have been teased in a little aqueous humour, obtained from the anterior chamber of the eye of a guinea-pig or a rabbit, and then exposed to the vapour of a 1 per cent. solution of osmic acid, the inner two-thirds of each cell will be seen to be filled with minute granules. During active secretion, these fine granules are discharged into the central lumen of each acinus, consequently the inner zone of each cell becomes narrower, and the outer zone, which contains fewer granules, becomes relatively wider. These granules consist of a zymogen, or mother-ferment, which is called *trypsinogen*. This substance is inactive, and has no digestive action upon protein food. In the succus entericus, however, the juice secreted by the Lieberkühn's glands, which line the mucous membrane of the small intestine, is a substance which Pawlow has named "ferment of the ferments," or *enterokinase*, the chief action of which is to convert the inactive trypsinogen of the pancreatic juice into a very active body called *trypsin*. Enterokinase has also a similar, although a slighter, energising influence upon the steapsin, or fat-splitting ferment of the pancreatic juice. The action of these proteolytic enzymes is, by a process of hydrolysis, to split the heavier protein molecule into much smaller molecules. The trypsin, in the presence of sodium carbonate, splits the protein into the proteoses, these, in turn, are converted into peptones, and these, in their turn, into simpler substances called polypeptides, which are groups of amino-compounds. The polypeptides are further converted into simpler substances still, such as leucine, tyrosine, aspartic acid, hexone bases, tryptophan, and certain ammonium compounds. Pepsin, the proteolytic ferment of the gastric juice, has a similar action to trypsin, though the resulting split of the protein molecule is not quite so complete, and the *velocity of action* not so rapid in the case of pepsin as it is in the case of trypsin. From what has been stated above, it will be seen that the pancreatic juice, as it is poured into the duodenum, contains no active proteolytic ferment whatever, but as soon as the pancreatic juice comes into contact with the succus entericus, it readily digests protein material. It is found, however, that stale pancreatic juice, obtained by extracting the crushed pancreas with water or glycerine, does contain a certain amount of active trypsin, capable of digesting protein food.

THE TRYPSIN TREATMENT OF CANCER.—In the *Archives of the Middlesex Hospital*, Vol. IX., containing the sixth report from the Cancer Research Laboratories, there is an account of the treatment of cancer by trypsin carried out by Drs. Walter Ball and E. Fairfield Thomas. The treatment which was carried out was as follows:—

"(1) Daily injections of trypsin (later, alternating with amylopsin) in doses of five minims, gradually increased to fifteen minims, the injections being made hypodermically, and with strict aseptic precautions, into the skin of the abdomen. Hypodermic injections were omitted on Sundays and Christmas Day.

"(2) The oral administration of 'Holadin' cachets, two or three daily, half-an-hour before food. This substance is an extract of pancreas, said to contain amylolytic and lipolytic enzymes.

"(3) Local application to the cancerous surfaces of lotio pancreatis (an extract from the pancreas for topical application) on lint, if to breast, or on tampons, if to vagina, cervix, etc.

"(4) 'Pancro-hepatic pepules.' Of these, which are a combination of pancreas extract and ox-gall, one was given every night."

In each case, the substances used were, by experiments with white of egg and starch solution, found to be physiologically active.

The cases, treated by these investigators, included those of carcinoma of the breast, carcinoma of the kidney, carcinoma of the tongue, carcinoma of the vulva, carcinoma of the cervix uteri, carcinoma of the rectum, carcinoma of the palate. A table is added, which shows that altogether eleven cases were treated by trypsin, the duration of treatment varied from 1 day to 118 days, the injections of trypsin varied from 1 to 58 in number, of amylopsin between 1 and 42. The conclusion drawn by the observers, mentioned above, is that the numerous large hypodermic injections caused the patients a very considerable amount of discomfort, occasionally inflammation and even suppuration followed. The trypsin treatment did not prevent the patients from showing a progressive loss of weight, and the course of the cancer, considered both as a disease and as a morbid process, was *unaltered* by the administration of trypsin and amylopsin. They add, moreover, that such authorities, as Mr. Pearce Gould and Dr. Lazarus Barlow, the former of whom was surgically in charge of the patients upon whom these observations were carried out, are in entire agreement with the conclusion which they have drawn.

THE AQUEOUS HUMOUR.—The anterior chamber of the eye is the space, which is bounded by the posterior surface of the cornea in front, by the anterior surface of the iris, and the part of the anterior surface of the lens, which is exposed to the pupil behind. The posterior chamber of the eye is somewhat triangular, its apex is at the point where the pupillary margin comes in contact with the lens, in front is the posterior surface of the iris, behind is the crystalline lens and its capsule, and on the outer side is the ciliary body. Both these chambers contain lymph which is known as the *aqueous humour*. This contains water, salts, and a trace only of protein, about ·045 per cent. For a considerable time, this fluid was held to be a secretion by the cells covering the ciliary processes. Now, however, it is looked upon rather in the nature of a filtration from the blood capillaries contained in the ciliary processes. The use of this lymph, or aqueous, is to nourish the lens and the vitreous, and, in addition, to keep up the normal intra-ocular pressure, which is about 25 mm. of mercury. The rate of the production of the aqueous humour is somewhat slow, and it has been shown that it takes nearly one hour for the aqueous humour in the anterior chamber to be completely renewed. If perforating wounds into the aqueous chamber occur accidentally, or are purposely made, as in the operation for the extraction of a cataract, the anterior chamber takes a much longer time to fill up in consequence of a certain amount of leakage, which must necessarily be taking place, through the original wound. The greater portion of the lymph, which is produced by the ciliary processes, passes at once into the posterior chamber, thence through the pupil, forward into the anterior chamber, the free communication between the two chambers being facilitated by the frequent movements of the iris. The aqueous now filters through the corneo-iridic angle into the venous plexus, which forms the canal of Schlemm, and which is placed at the corneo-scleral junction, thence into the anterior ciliary veins. A small quantity of the fluid, secreted by the ciliary processes, passes back in order to nourish the vitreous. The lymph then passes into the canal of Cloquet, a tubular lymph space running from the posterior part of the lens capsule to the optic disc. This is the lymph space which originally surrounded the fœtal hyaloid artery. The canal of Cloquet communicates with the perivascular lymph spaces, which surround the central vessels of the retina. In this way, the lymph passes out of the eye by way of the optic nerve into the vaginal lymph space.

SEA-BATHING AND DISEASE OF THE EAR.—Acute diffuse inflammation of the external auditory meatus may be due to foreign bodies introduced from without, such as pieces of wooden matches, the taper end of a pen, peas, etc., but one of the most frequent causes is bathing in the sea. The cold salt water readily enters the meatus through the force of the waves, and sets up an inflammatory condition. The patient complains of pain in the meatus, which is increased by pressure exerted over the tragus. Later, there is a discharge from the meatus. On further examination of the meatus, considerable swelling of the walls may be noticed, especially in the deeper portion, the membrana tympani may be injected. Deafness, as a rule, is present, but the degree varies with the amount of swelling of the meatus and the discharge, which interfere with the action of the membrana tympani. The prophylactic treatment consists in prohibiting sea-bathing for those persons who are liable to disease of the ear, unless they use some protection for their ears. Dr. Urban Pritchard says "the best safeguard is afforded by putting a large piece of cotton wool into both ears, and wearing an oilskin cap fitting tightly over them." The treatment consists in counter-irritation behind the ears in the form of blisters, or iodine paint, leeches applied in front of the tragus, hot fomentations, purgatives, or *soothing* injections or instillations. No forcible syringing must on any account be allowed.

The following injection, carefully used, will be found to afford the patient considerable relief:—

℞. Liquoris Morphinæ Acetatis - - ℥ss.
Liquoris Plumbi Subacetatis Diluti - ℥ss.
Aq. Dest. - - - ad ℥xij.

One table-spoonful to be put into a wine-glass of *warm* water, and to be syringed *gently* into the external auditory meatus.

Aqueous solutions of Atropine, of a strength 1 grain to an ounce, or of morphia, of a strength 2 grains to a drachm, if used *warm*, are found to be good instillations.

Sir William Whitla says "to relieve acute pain in the ear, whether from the meatus, or the tympanic membrane, the best application is a solution of 10 per cent. each cocaine and carbolic acid in water. A very few drops, poured into the ear out of an egg-spoon (previously warmed), seldom fail to give relief."

Preparations, Inventions, etc.

FORMAMINT TABLETS.

(Messrs. A. Wulfing & Co., 83 Upper Thames St., London, E.C.)

The disinfectant action of formic aldehyde upon mucous membranes is well known. In combination with milk sugar, the compound of which the chemical formula is probably $5CHOH + C_{12}H_{22}O_{11}$, it has received the name of formamint, and is to be obtained in the form of easily soluble tablets. Each of these tablets contains so much of this new chemical combination that, when it dissolves in the saliva, ·01 of formic aldehyde is set free, and in its *status nascendi* exercises a strong disinfectant action. A small quantity of citric acid is added to render the taste agreeable and refreshing. Formamint tablets are especially indicated in the treatment of infective diseases of the throat, and in various forms of subacute and chronic pharyngitis. They act as substitutes for gargles, and disinfect the area of disease locally, while they are also absorbed internally, and influence the whole organism. The great bactericidal value of formamint is therefore of considerable importance in general practice, because of the great difficulties hitherto associated with gargling, not only in regard to children, but also in the case of adults. Generally, the advantages of formamint are—it is a proved antiseptic and bactericide, it is non-toxic in action, it is more effective than gargles, it is pleasant to take, and, in the form of tablets, it is conveniently portable.

SAJODIN.

(Messrs. Meister, Lucius & Brüning, Ltd., 51 St. Mary Axe, London, E.C.)

Sajodin is a perfectly tasteless and thoroughly efficient substitute for potassium iodide, and free from secondary effects. Its sphere of indication consequently coincides with that of the well-known iodine salts, and its employment is especially advisable in the manifold forms of tertiary syphilis, also during the secondary period; in headaches, periostitic pains, in arteriosclerotic affections of the blood vessels, bronchial and cardiac asthma, angina pectoris of vasomotor origin, chronic bronchitis, also apoplexy, even when not of syphilitic origin, etc. Being an inodorous, insoluble and tasteless powder, it is easily taken on the tongue, and washed down with water. Its action, in general, is prompt, and, although it contains less iodine than the same dose of potassium iodide, is approximately equal to it.

"TABLOID" BRANDS, ANÆSTHETICS AND ANTISEPTICS.

(Messrs. Burroughs Wellcome & Co., London.)

Xaxa et Phenacetini.—This is an excellent combination of xaxa (*vide* THE PRACTITIONER, vol. lxxvii., p. 143), with an analgesic and antipyretic.

Xaxaquin is a new quinine salt, combining the therapeutic activities of quinine and acetyl-salicylic acid, and possessing advantages over quinine salicylate similar to those of "xaxa" over salicylic acid.

Xaxa et Xaxaquin.—This combination presents the valuable antiseptic, antipyretic, and specific properties of the salicylates without their disadvantages, combined with the antiperiodic and antipyretic effect of quinine. It is valuable as a prophylactic, and, in the early stages of catarrh and influenza, exerts a beneficial effect, and relieves pain in tonsillitis, gout, rheumatism, malaria, and other fevers. All these "tabloids" can be obtained in bottles of 25 and 100.

"Tabloid" pleated compressed Sterilised Bandages and Dressings.—The convenience of these dressings, which are now supplied sterilised, will be highly appreciated by busy practitioners, for, in country practice and in emergency work, they are of the greatest value. They are compact, portable, and can be relied upon, and are thus rendered very satisfactory for all purposes for which they are needed. The compressed cotton wool and lint are supplied in one ounce and two ounce packets, and the compressed gauze in three yard lengths.

"Wellcome" Brand Anæsthetics.—Chloroform and ether. In order to avoid the possibility of deterioration under the influence of air and sunlight, the *Wellcome Brand Chloroform* is issued in hermetically sealed and amber-coloured glass tubes. and *"Wellcome" Brand Ether*, sp. gr. 720, is also issued in hermetically sealed glass tubes. It is, therefore, possible always to obtain chemically pure anæsthetics, perfectly fresh, and, as a further assistance, these tubes, in both cases, contain accurately measured quantities. As a precaution against possible risk of breakage, each tube is separately packed in a wooden container.

Nizin.—The application of many antiseptics in common use often causes local irritation, while general toxic symptoms may follow their absorption. In "nizin" we have a new product, a zinc salt of sulphanilic acid, which possesses many distinct advantages, for it is a valuable antiseptic, readily soluble in water, and produces no irritation and no toxic effects.

It has been found to be of great value in acute gonorrhœa, and of marked superiority to the salts of zinc hitherto in use. Treatment by urethral and vaginal injections causes no smarting, scalding pain, or inflammatory swelling. It causes little or no inconvenience to the patient, and shortens the duration of the treatment. In gonorrhœal ophthalmia, conjunctivitis, and other eye affections, "Soloid" "Nizin," gr. 2, affords a ready and convenient method of preparing eye lotions. It is supplied in bottles of 100 at 1s. per bottle.

PHARMACEUTICAL PRODUCTS.

(Messrs. Bayer & Co., Ltd., 19, St. Dunstan's Hill, London, E.C.)

Liquid Somatose.—Somatose is prepared from beef and contains soluble albumen and salts. In a liquid form it is agreeable, and is readily taken by fastidious people and children. For the latter, the sweetened preparation is particularly suited, while the unsweetened form is conveniently taken with water, or in broths, soups, etc., by persons for whom the use of sugar is objectionable. Both forms are indicated in conditions of malnutrition, and in such exhaustive diseases as phthisis, anæmia, rachitis, typhoid fever, pneumonia, influenza, gastro-intestinal affections, and such like. They are quite free from alcohol or any antiseptic.

Small neat oval bottles, containing 25 or 100 tablets of the following preparations, have recently been issued, and appear to us to be exceedingly useful. These tablets contain 5 grains each of the special preparation :—

Aspirin.—This is indicated in all diseases in which salicylate of sodium is commonly employed, such as rheumatic affections, gout, influenza, chorea, pleurisy, glycosuria, scarlet fever, quinsy, etc. It also possesses a specific analgesic virtue in neuralgia, tabes dorsalis, dysmenorrhœa, carcinoma, etc., and is useful in various ophthalmic affections.

Helmitol.—This is a salt built up of citric acid, hexamethylenetetramine, and formaldehyde, readily soluble in water, and possessing a pleasant acid taste. It is indicated in such diseases as cystitis, pyelitis, urethritis, septic bacteruria, and phosphaturia.

Heroin Hydrochloride.—This is a derivative of morphine of the formula $C_{17}H_{17}NO(O.CO.CH_3)_2$ HCl, and is chiefly indicated in diseases of the air passages attended with cough, difficult breathing, and spasm, such as bronchitis, pneumonia, consumption, asthma, etc., etc. In fact, it may be employed in nearly every case, in which morphine is indicated, without detriment to the general health of the patient.

Trional—Bayer.—The sleep induced by trional is peaceful and refreshing, hence it has been pronounced to be "*the hypnotic par excellence.*" It produces the best results in sleeplessness due to slight disturbances of the nervous system, and is especially indicated in maniacal dementia, delirium tremens, hysterical, and epileptic fits, etc.

Tannigen.—This is a preparation which, after passing through the stomach, is still effective in the lowest portions of the intestinal tract. Hence it is indicated in acute diarrhœal affections, summer diarrhœa of children, and dysentery, also for the diarrhœa consequent upon typhoid fever and intestinal tuberculosis.

Veronal.—Like trional, this has been found to be an effective hypnotic, and no bad effects follow its administration.

Full particulars for the administration of these preparations are supplied with them.

HALL'S SANITARY WASHABLE DISTEMPER.

(Messrs. Sissons Brothers & Co., Ltd., Hull.)

This distemper can be obtained in 70 different shades of colour, and is supplied in preparations suited for either external or internal decoration. As a substitute for wall papers, it appears to us to be especially useful from a hygienic point of view, for when first applied, it is a thorough disinfectant and germ destroyer. As it is perfectly washable, it commends itself at once as a suitable means of effective and agreeable artistic internal decoration, while the uniform character of the various shades can be made particularly restful to the eye. Hospitals and similar institutions should find it of great value, for it is cheap and practical, and is entirely free from the objectionable smell of paint.

THE PRACTITIONER.

SEPTEMBER, 1907.

NOTES ON THE REMOVAL OF THYROID TUMOURS.

By ARTHUR E. BARKER, F.R.C.S.,
Professor of Surgery at University College Hospital Medical School, and Surgeon to the Hospital.

[With Plates VII.—VIII.]

THE details of removal of tumours of the thyroid body have been, perhaps, less studied in this country than abroad, owing to the smaller number of such cases met with here. Anything like the material, for instance, met with in Switzerland, is never likely to claim the attention of surgeons in England. There the three thousand odd already operated upon in Kocher's Klinik, to say nothing of the many hundreds recorded by Socin, Kröhnlein, Reverdin, and other Swiss surgeons, offer opportunities for formulating procedures which we can never expect to rival. And yet a hospital surgeon in this country has to be prepared to deal with such cases pretty often, for, thyroid tumours of various kinds are sent to London, and operated on in the provinces in considerable numbers. Looking over my own hospital records and private notes on this point, I find that, during the last few years, I have been called upon to operate on 22 such cases, in addition to many more operated on earlier. And in doing so, one has had to familiarise oneself with those methods and details which, in the hands of our Swiss colleagues, have given the best results.

A short review of what has been done, and found in these 22 cases may prove interesting and instructive.

The first point to be settled in the mind of the operator is what form of anæsthesia he will use. The dangers of general anæsthesia in such cases have been long known. There have been such that Kocher, and many other surgeons of large experience, have made it a rule, for many years past, to avoid both ether and chloroform, and to employ local anæsthesia for almost every case of excision of thyroid tumours, even where it was impossible to avoid all trace of pain. For some years past, in my own cases, I, too, have, as far as possible, employed local anæsthesia, and am told by those, including one of his own assistants, who have seen Kocher's cases, that the absence of pain, in my cases, has been far more complete than in his. Indeed Kocher, in his last publication, expressly says, that "we avoid general narkosis in every case where the patient can bear a certain amount of pain." He implies thereby, as I take it, that his method of local analgesia is necessarily imperfect, and is usually insufficient to wholly prevent pain. Operating quite recently on a very serious case of retrosternal goitre in a nervous girl, in the presence of one of Professor Kocher's assistants, the analgesia was so complete that the latter assured me afterwards that we must have an entirely different class of patient to deal with in this country, or a different method of local analgesia, and that he had never seen local analgesia so complete. But, on enquiry, I found, as I expected, that the method employed in the Klinik in Bern was quite different, and only aimed at rendering the skin insensitive, while, in my own cases, the end in view was to render *the whole field of operation*, even the deeper structures, analgesic. The solution used in these cases was that described in a paper, which I published in the *British Medical Journal* of December 24, 1904, and the general principles of employing this method of analgesia are also given there. A few words on the procedure, as applied to thyroid operations, may not be amiss here. The solution of 2 per thousand of B. Eucaine in normal saline is best prepared *fresh*, by adding a powder containing B. Eucaine 3 grains, Sod. Chlor. 12 grains, to 100 c.-centimeters = 3½ ozs. of distilled water in a small *hand* glass flask, with a mark on the neck showing the amount of distilled water to be used. This is boiled for a few minutes and then cooled to blood-heat. To this, when thus cooled, are added ten drops of adrenal chloride solution 1 in 1,000. We have then the following solution :—

B. Eucaine	0·2	grammes.
Sod. Chloride	0·9	„
Adrenalin Sol.	0·5	„
Dist. Water to	100·0	„

This means two per thousand of B. Eucaine and one in two hundred thousand of adrenalin in normal saline ; a very dilute solution of the two essential ingredients, but purposely weak in order to admit of use in large quantity.

The injection is best done in the ward while the patient lies comfortably in bed. It is made first with a small sharp Freienstein's needle *into the skin,* not *under* the skin, all along the line of the curved incision usually employed (Kocher's), Figs. 1 and 2. This injection should distribute the fluid pretty widely about the track of the incision, so as to reach all nerve filaments likely to be divided. This will require about 30 c.c. The short sharp needle is then exchanged for a very long one of somewhat larger size. This is closed at the end, which is rounded and polished, and has an eye close to the point. It cannot of course be thrust through the skin itself, but requires a puncture to be made for it with an ordinary suture needle with sharp point and edges. A straight Hagedorn's needle is perhaps the best. This puncture is made in the line already injected, and, by preference, at one corner of the curved incision line. The blunt long needle is thrust through this puncture into the subcutaneous tissue, and is slowly pushed across the neck towards the other horn of the incision, the fluid being injected as it goes (Fig. 2). It is then partially withdrawn and pushed outwards and downwards for a couple of inches, and again nearly straight upwards. The fluid thus diffused, which will equal 30 or 40 c.c., will cross the track of most, if not all, of the branches of the cervical plexus going to the area of skin in the field of operation on one side. Then the needle is thrust in the same directions from a puncture at the other horn of the curved incision, and the same process is repeated. The same blunt needle is then pushed between the deeper layers of the cervical fossa round the capsule of the thyroid on both sides, and the rest of the fluid is injected on both sides (Fig. 2). For a tumour of moderate size, 100 c.c. are ample, but, for larger swellings, up to 150 c.c. may be employed, but this is rarely necessary if the fluid is evenly distributed over the area indicated. This abundant use of a very weak solution with adrenalin produces a good deal of what one may call an artificial œdema, but this disappears before long, and, at the end of from 40 minutes to an hour, the analgesia is at its height, and the œdema is practically gone. Another desirable effect of the injection is now seen in the comparative bloodlessness of the whole area of operation. To operate before at least half an hour has elapsed since the injection is a mistake, where adrenalin has been employed. Adrenalin delays the effect of B. Eucaine, but prolongs its action for on an average about 2½ hours. In some of the published cases of local analgesia which have recently appeared, this error of operating at once has been made, and doubtless in many others. The secret of a good local analgesia is to inject a large amount of a dilute solution, with due regard to toxicity, and to wait a sufficient time before operating. As to toxicity, it is largely reduced by the action of adrenalin, and I have injected 200 c.c. of the above solution without ill-effect. But this amount would not often be nearly approached.

In cases, in which we are dealing with nervous patients, it is well to give a quarter of a grain of morphia shortly before the operation. It induces a sense of calm and restfulness, though, as we know, some patients are made sick by it.

At the end, say of three-quarters of an hour to one hour, the patient can be brought into the operating room, and the operation is begun by a curved incision beginning over the border of the sterno-mastoid muscle on one side at the level of the upper pole of the lobe, and sweeping down to within half an inch of the episternal notch and up again to the same point on the opposite side (Fig. 1). This is rapidly deepened until the borders of the sterno-mastoids are seen and the flap, consisting of skin and platysma, is turned up and covered with sterile gauze. The cervical fascia, over the sterno-hyoid and thyroid muscles, is best divided vertically in mid line, when the muscles can be drawn aside with hooks, exposing the capsule of the gland. But, where the latter is much enlarged it may be necessary to divide these muscles; this, however, is very rarely necessary, and is, of course, better avoided. I have never been obliged to divide them. The next step is probably the most important in the operation, viz., the finding of the capsule of the gland, which is a very thin structure normally. But, with a forceps and curved director, it may be cleared and recognised after a little practice. Where an adenoma is present, the capsule is thin enough to allow of the blue-pink colour of the tumour to be seen through it. It is then cautiously cut or torn through, and, with the curved

PLATE VII.

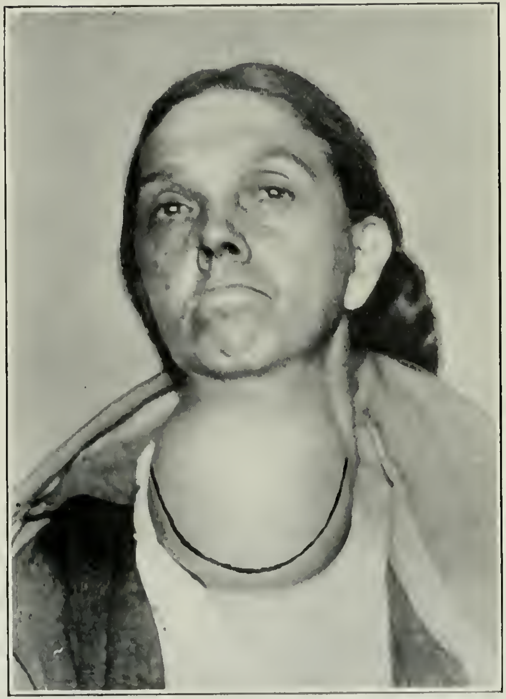

Fig. 1.—*Heavy line shows the direction of Kocher's "collar cut" where a large tumour has to be removed. For smaller tumours a somewhat less extended incision would be necessary.* Case 18.

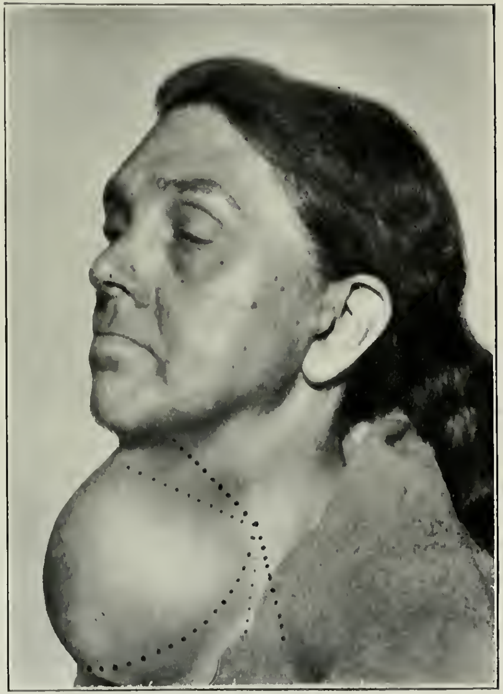

Fig. 2.—*Heavy dotted curved line shows the direction of injection in the true skin for the "collar cut"; heavy dotted straight lines, the direction of the subcutaneous injection for superficial nerves; light dotted straight lines, the direction of the injection for the capsule of the thyroid.* Case 18.

Plate VIII.

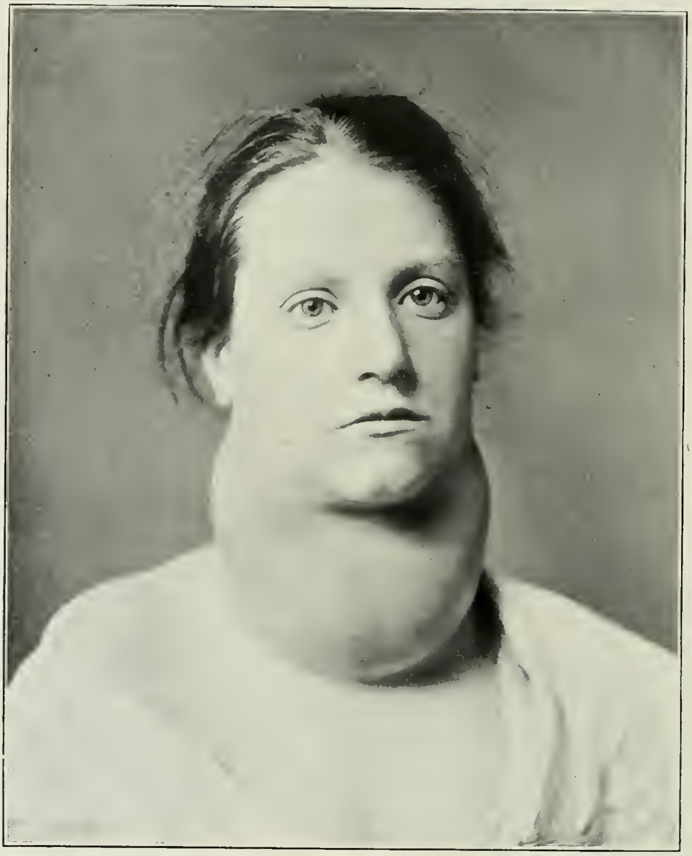

Fig. 3.—*Large soft lobulated adenoma. Case* 4.

director inserted under its edge, which is held in forceps, the tumour may be easily separated, and shelled out with very little bleeding. If this interval between the adenoma and the capsule is not hit off accurately, not only is the dissection difficult, but the capsule, which is very vascular, bleeds freely. The oozing from the interior of the capsule, when the adenoma is being shelled out, may possibly be smart for a moment, but, if the cavity is packed with gauze for a minute or two, stops readily. A little more tendency to bleed is met with when the adenoma is covered by normal gland tissue, and this has to be cut through. But even here pressure with dry gauze will arrest the blood, and, if the tumour is cleanly stripped out and the cavity packed, the latter is dry, as a rule, before the skin stitches are in place. Before the stitches are tied, the flap is thrown back and the packing removed for a thorough overhaul of the wound to wipe away clots, and dry with fresh gauze. Then the flap is laid down and the sutures are tied, a strand of gauze being left in the lowest part of the incision above the sternum for twenty-four hours if need be. But, so far as my own cases are concerned, this has not been necessary in the majority, the wound has been completely closed at once, and I have never had cause to regret having done so. I know that Kocher, in his notes on his last 1,000 cases, gives reasons for routine drainage, but the tumours, which he has removed, have been, as a rule, larger than in my own cases.

But this method of enucleation, which has been the usual course pursued in the cases here abstracted, is not of course always the best procedure. We meet with others, in which the greater part of a lobe is so studded with small adenomata or cysts that the only effectual operation is the removal of the entire lobe. This may be a very easy matter, or one of the most difficult operations. If the lobe is large and jammed down behind the sternum, I know of hardly any procedure, which requires greater care, and is more difficult than its enucleation and removal. And yet here, too, I have found local analgesia carried out as above quite adequate. And it must be remembered that some of the smaller tumours, which lie deep and press upon the side, or even back of the trachea, while their lower borders lie beneath the top of the sternum, are often far more difficult to remove than swellings ten times their size, which project forward between the sterno-mastoids and more or less overhang the sternum. There are several of both classes in our list. Of the deep-lying tumours, more or less beneath the border of the sternum, Nos. 8, 2, 17 and 22 are good examples; of the large cystic form overhanging and easily removed, No. 18 (Figs. 1 and 2), and of the large parenchymatous form No. 4 (Fig. 3).

The removal of a whole lobe differs but little from that of an adenoma, except in the fact that vessels require more attention. The enucleation of the lobe is carried out external to the capsule, in this case by stripping with the director, aided by an occasional snip with curved scissors. Indeed the curved scissors is one of the best directors, the lower blade when necessary being thrust under successive strands of alveolar tissue, and the upper blade dividing them. Nothing could have been more satisfactory than one of the last cases, No. 21, of deep-seated tumour. Here the young woman was suffering from very severe dyspnœa and cough, which hardly allowed her to sleep. The shelling out was rapidly done and without pain, with the help of the scissors as above; finally, one or two sweeps of the finger were made on its under surface, and it was dislocated forwards and inwards, when the patient exclaimed "What a relief!" and all her symptoms at once disappeared. When the whole lobe has been dislocated forwards, my own practice has been to catch successive small masses of tissue at the points of entry of the thyroid vessels in hæmostatic forceps, and then divide the tissues close to the capsule of the gland. These forceps are left on until the lobe is quite removed, and until the stitches in the skin are all in place, and ready to tie. The flap is then thrown up again, the gauze packing taken out, and then the forceps are removed, where obviously not on vessels of any magnitude. Those which evidently include larger vessels are drawn forward, and the latter are ligatured. But I have been over and over again surprised at the small number which required any ligature at all. Anything like the procedure of tying dozens of vessels, described by others, I have never been obliged to resort to. The ligatures, in my cases, in the four cases in which they have been used, have been made with fine *linen* thread, sterilised by boiling, and preserved, between operations, in spirit.

Case 1.—Annie D., æt. 49, noticed swelling in the neck when 17 years old. It disappeared under painting with iodine tincture. About a month before admission, swelling began to enlarge, causing a sensation of a lump in the throat. Dyspnœa and palpitation on exertion, but no other pressure symptom.

Physical state. Tumour of right lobe of thyroid size of an egg. It is well defined and elastic like a cyst.

Operation, March 15, 1900. Local analgesia. Kocher's "collar cut." Through this incision, one larger and two smaller lobules, the last partly calcareous, were removed, and the wound was closed without drainage. It was quite healed without any contretemps by the 28th March.

Case 2.—Emily J., æt. 41., has had a large swelling of the thyroid for five years, gradually increasing. She says "about 2 inches in the last year." It causes difficulty in swallowing, and lately shortness of breadth.

Physical state. Patient is very stout; she has a large cystic swelling under the left sterno-mastoid muscle, extending high up the neck, and crossing the trachea to form a smaller tumour under the right sterno-mastoid. The trachea appears to be flattened from before backwards, and is pushed towards the left side.

May 10, 1900. Local analgesia. Kocher's "collar cut" exposed the muscles. The deeper were separated in the middle line, and a large cyst was exposed. This was shelled out, during which process it was punctured, much brown fluid escaping, and, with the rest of the tumour on the right side, it was completely enucleated. There was considerable bleeding. A small gauze drain was inserted over the sternum, and the wound was sewn up. The iodoform gauze drain was removed on the third day, and again on the fifth and ninth day. The wound healed *per primam*, except at the drain opening, and this was quite closed on the eighteenth day. There had been a rise of temperature during the first couple of days, while serum was escaping, but no other symptom to excite attention. She was completely relieved as to voice and dyspnœa, when she left hospital on the nineteenth day.

Case 3.—Emily T., æt. 40, noticed a tumour at least four years, with great difficulty in swallowing and increase of late; it fluctuates in size about once a month with great headache when largest. Patient is very nervous and depressed.

Physical state. Fluctuating swelling in right lobe of thyroid, the size of a walnut, very movable. This is clearly a cystic adenoma. No exophthalmos, but there is anæmia, and systolic murmur at apex.

Operation, August 10, 1900. The tumour was shelled out through an oblique incision along right sterno-mastoid, and the wound completely closed. Union *per primam* without any trouble. Mode of anæsthesia not given in notes.

Case 4.—Mirian W., æt. 17, large swelling of thyroid since patient was 12 years old. Measurement round the neck 14 inches. Patient suffers from palpitation, and is sometimes sick with frontal headache almost daily.

Physical state. Very great enlargement of thyroid, the lateral lobes of which almost reach the lobes of the ears; the lower margins reach to the middle of the clavicles and overlap the sternum. (*Vide* Fig. 3.) Tumour fairly soft and lobular. Dyspnœa on exertion, but not at night. No stridor, but weak voice. Health good. Loud, rough, systolic murmur.

Operation, October 23, 1900. Kocher's curved "collar incision," under B. Eucaine analgesia without adrenalin. For the deeper dissection chloroform was necessary. There was much difficulty in defining the capsule, and enucleating the tumour, which was done in several lobes. This gave rise to much bleeding. The vessels at the base of the right lobe were clamped and divided. The greater part of the left lobe was left untouched. The tumour removed proved to be a soft lobulated adenoma. There were no degenerated patches or cysts.

The first packing and plug were removed on the fifth day, and the stitches on the tenth, after which there was nothing to note except perfect convalescence. The shock of the operation, which was marked owing to loss of blood, was recovered from in a couple of days.

It is worth recording that the left lobe, which was left untouched, distinctly decreased in size after the operation, while the patient could be kept under observation.

The eucaine analgesia was in this case done without the addition of adrenalin, the effect consequently passed off too soon for the completion of the operation.

Case 5.—Sarah G., æt. 50, stout, florid woman, noticed a year ago a swelling on the right side of the neck, increasing steadily, and extending ultimately to the left side of the neck. Three weeks ago began to have slight dyspnœa.

Physical state. There is a thyroid enlargement reaching on the right side to the clavicle. It is the size of a pigeon's egg, and slightly displaces the trachea. The upper border cannot be defined, and may involve the whole thyroid lobe. The swelling is elastic. There is a small indefinite swelling, too, in the right lobe.

Operation, March 8, 1901. The tumour was enucleated through Kocher's "collar cut," and proved to have calcareous walls. There was very little bleeding. A small gauze drain was left in. The stitches were removed on fifth day, primary union being found except where gauze drain lay. Left for home quite healed on tenth day. Form of anæsthesia not stated in notes.

Case 6.—Mary C., æt. 23, anæmic, and with slight hæmic murmur over second right c.c., noticed a lump, about the size of a walnut, on left side of neck six months ago. The left lobe of thyroid projects forward, and a rounded tumour can be felt in it, which feels like a small adenoma or lymph gland.

Operation, March 28, 1901. The tumour was enucleated, and proved to be an adenoma with cysts containing blood. It appeared to be in an accessory thyroid. The stitches were removed on the tenth day, when primary union was found.

This patient returned two months later with enlarged glands in the left posterior triangle, which, on removal, proved to be alveolar sarcoma. The microscopic structure of the thyroid tumour was that of typical degenerating adenoma.

No statement as to anæsthesia in the notes.

Case 7.—Emily B., æt. 30, a delicate woman, noticed a lump, six years ago, which has been growing larger, and lately causing inconvenience in swallowing.

Physical state. Lump size of hen's egg, of oblong shape, the lower pole lying over the trachea at the manubrium. It is rather more fixed than usual. There is dyspnœa on exertion.

Operation, April 25, 1901. Kocher's "collar cut." Enucleation was done with difficulty, the cyst bursting before completion. It was a thin-walled cyst with lumps of thyroid gland tissue projecting into it. Primary union by ninth day. Left for home twelfth day.

No mention of anæsthesia in notes.

Case 8.—Eliza H., æt. 19. Has had an enlarged thyroid tumour for seven years, gradually increasing until present time ; is now two inches across, and appears plainly in the substance of the gland. Patient is very short of breath, and her voice is much affected on the slightest trace of cold. She has dysphagia.

Operation, September 26, 1901. Kocher's "collar cut." Capsule of thyroid opened and the tumour, *which passed down behind the sternum*, was removed without difficulty, only one vessel requiring ligature. The wound was stitched up without drainage.

The tumour was a cystic adenoma.

The wound healed by primary union under one dressing. Symptoms quite relieved. Form of anæsthesia not given in notes.

Case 9.—Esther W., æt. 25. Two years ago noticed a lump in the left side of the neck in the thyroid. Has dyspnœa and dysphagia in varying degree.

Operation, October 24, 1901. Kocher's incision as before. Left lobe of thyroid found the seat of diffused adenomata, some cystic, the largest the size of a walnut. The whole left lobe was removed, very little bleeding, no ligatures required.

The wound was closed without drainage.

Wound healed by first intention.

Case 10.—Florence B., æt. 52.—Noticed tumour in thyroid seventeen years ago. Larger now, and for four months has been painful. No dysphagia or dyspnœa.

Chloroform. Operation, December 5, 1901. Kocher's incision. A swelling in right lobe of thyroid was first enucleated with ease, then that on the left after division of the capsule. No drainage.

Uninterrupted recovery. Union *per primam*.

Case 11.—Mary B., æt. 36. First noticed a lump in the front of the throat five months before admission, but it gave no trouble. Three weeks ago, dysphagia began with pain and some dyspnœa and headache. There is now a swelling, probably cystic, in the right lobe of the thyroid about the size of a Tangerine orange.

Operation, January 23, 1902. Chloroform. Kocher's "collar cut." Capsule incised, and tumour shelled out without difficulty. At the last moment the cyst burst. No ligatures, no drainage. Union *per primam*. The tumour was a typical cystic adenoma.

Case 12.—Louisa L., æt. 22. Admitted for swelling of neck, present 18 months, and lately causing dyspnœa and dysphagia. The left lobe of the thyroid is about the size of a Tangerine orange, and reaches to the sternum.

Operation 1903. Local analgesia, B. eucaine + adrenalin. Usual "collar cut." A small cyst was enucleated from the left lobe, but burst during the process. No ligatures, no drainage. Primary union. The patient was hysterical, and appeared to feel much pain, but afterwards she said, "There had been no severe pain, but she felt that she must scream."

Case 13.—Ellen B., æt. 17. Has had an enlarged thyroid for three or four years. Nine months ago it began to increase. Has no pain, but suffers from shortness of breath and nausea. The mass is now of the size of a Tangerine orange, and lies in the lower part of the right lobe of the thyroid.

Operation, January 1904. B. eucaine + adrenalin analgesia. "Collar cut." The typical adenoma was enucleated with some difficulty from the right lobe. A gauze drain was inserted in the lowest part of the curved incision. No ligatures. Union perfect when gauze drain was removed.

The analgesia was good. Patient complained sometimes when limit of infiltration was passed, and when pressure was made to dislocate the tumour.

Case 14.—Rose M., æt. 17. A lump was noticed in the left lobe of the thyroid about three weeks ago, the size of a Tangerine orange, soft, but not fluctuating. Right lobe normal.

Operation, July 14, 1904. Usual curved incision. Local analgesia. Enucleation of the tumour (which was cystic) without trouble. No ligatures, no drainage. Union *per primam*. "Patient felt no pain whatever."

Case 15.—Elizabeth S., æt. 47. Complains of a lump in the left side of neck, which appeared 27 years ago. About two

two years ago, another lump appeared on the right. There is dysphagia, and occasionally dyspnœa and palpitation.

Operation, November 15, 1904. Kocher's curved incision, both tumours of small size enucleated easily, and without bleeding to any extent. No ligatures, no drainage. Primary union. Recovery uneventual. The local analgesia is described in the Hospital Notes as "*perfect.*"

Case 16.—Mary H., æt. 46, healthy, has a rapidly increasing lump, the size of a large plum, in left lobe, deflecting trachea to the right. There is no stridor. The tumour is smooth, rounded, and elastic.

Operation, May 24, 1906. "Collar cut" incision, muscles separated, and tumour nucleated, but it burst before complete removal, giving exit to much brown fluid. Wound closed without drainage. Primary union. Local analgesia quite satisfactory.

Case 17.—Henry P., æt. 21, swelling of neck for four years, fluctuating in size. For 18 months increasing continuously. The neck is now very much swollen by a soft general enlargement of thyroid, the isthmus being apparently about 2½ inches broad. The lateral lobes descend behind the clavicles, and there is very little movement on swallowing. The trachea is compressed from before backward, at 4th to 6th ring, causing shortness of breath, and sweating on exertion. No tremor, tachycardia or exophthalmos. Well-marked murmur at heart apex, and second sound accentuated.

Operation, October 18, 1906. Local analgesia. "Collar cut," muscles retracted. Dislocation of the right lobe, became painful, and chloroform was given for a short time. Superior and Inferior thyroid arteries ligatured. The isthmus was divided without much bleeding. Wound closed except at lowest curve, where a gauze drain was inserted. The local analgesia was good, until the dislocation of the very large right lobe from behind the clavicle, when it had to be supplemented by chloroform for a short time.

Recovery was perfect, and patient left for home on 16th day. He has been seen recently quite well, the swelling of the remaining lobe having decreased since removal of the right.

Case 18.—Mary J., æt. 57, admitted for enlarged thyroid, which is said to have been present all her life, but has recently been increasing rapidly. It now reaches from the hyoid bone to the lower borders of the clavicles, and is about the size of a cocoa-nut (Fig. 1). It is mostly cystic except on the left side, where it is nodular, the veins over it enlarged. There is no alteration of the voice, but there is dyspnœa on exertion.

Operation, November 20, 1906. Local analgesia. Usual "collar cut." The flap, consisting of skin and platysma, was raised, and the infra hyoid muscles, which were much stretched, were drawn aside. It was difficult to define the capsule, and, in doing so, the cyst gave way, and a large quantity of straw-coloured fluid escaped. The opening was clamped to preserve the contour of the tumour, which was, in its reduced size, easily shelled out with very little bleeding. A gauze drain was inserted over the sternum, and the rest of the wound closed. There was some pain when the deeper part of the tumour was being dragged on, but no dyspnœa. The tumour consisted of one thick-walled cyst, consisting of thyroid tissue covered by condensed tissue. Recovery was uninterrupted, and the patient left for home on December 11, 1906.

Case 19.—Sarah H., æt. 19. Well-nourished girl, but inclined to cold extremities and chilblains. The thyroid seems generally enlarged, and, in addition, there is a hard lobule the size of a cherry to the left of the middle line, which is fixed to the thyroid. There are no toxic symptoms.

Operation, December 6, 1906. Local analgesia. Hypodermic of morphia, gr. $\frac{1}{4}$. "Collar cut" as usual; *infra* thyroid muscles drawn aside, and the right lobe was enucleated with a narrow bladed elevator, until it was nearly free. This gave no pain. The deeper separation was finished by a sweep with the finger, which caused a moment or two of distress. It proved to be a large semi-solid adenoma, which reached behind the sternum. The rest of the operation was without any distress. The separation of the tumour from its mesial attachment was easy. Three or four vessels were tied, and one oozing spot was touched with Paquelin's cautery. The wound was closed without any drainage. Primary union followed without interruption. The improvement of all symptoms was very remarkable in this case.

Case 20.—Mary F., æt. 44. Healthy looking, has a rounded tumour of thyroid under the border of the right sterno-mastoid muscle. This has been slowly getting larger.

Operation, March 7th, 1907. Local analgesia, Usual incision. Three adenomata were enucleated with curved director. Union *per primam* without drainage. All symptoms relieved.

Case 21.—Elizabeth R., æt. 21, admitted for thyroid tumour and dyspnœa, which has been present since the appearance of the tumour, and has been increasing greatly of late. The lump is the size of an orange, mostly on the right side, but extends across the mid line. It extends behind the sternum, and has the muscles stretched over it. The larynx and trachea are pushed over to the left. The voice is hoarse, and stridor is very harsh, even when lying still in bed. The patient has also a paroxysmal cough, which keeps her awake at night, and she prefers to be propped up in bed.

Operation, March 28, 1907. Local analgesia. Usual curved incision. The muscles were drawn aside, and the first part of the enucleation was done with a curved elevator. As the tumour lay very deep behind the muscles and upper edge of the sternum, the last part of the dislocation of the mass forward had to be done with a sweep of the finger. This was completed in a few seconds, during which the patient complained of a drag on the larynx, followed by the expression, "What a relief," as the tumour slipped forward out of its deep bed, and freed the air passages of all pressure. The mass was now cleared from its mesial attachments by a few snips with scissors, which caused no pain. No vessels required ligature, and the wound was closed except at its lower curve, where a gauze was inserted. Healing took place in the most perfect manner. The relief of all the patient's symptoms was, in this case, most remarkable. The case illustrated, in a very marked way, the severity of dyspnœa produced by a tumour of moderate size caught beneath the sternum. The mass, which was about the size of a turkey's egg, proved to be an adenoma undergoing colloid degeneration.

It will be seen, in this list, that there has been a great deal of variety in kind of tumour, for which operation was required. All were non-malignant. They were mostly examples of adenoma, some cystic, and some showing various degrees of colloid degeneration going on to the formation of cysts. In a few, the latter were large and thick-walled. The more difficult ones to deal with (3) were those in which the adenomatous change was widely disseminated, and a whole lobe or more had to be excised, owing to the impossibility of removing the adenomata singly. But the most difficult cases of all were those (4) in which not only was there a disseminated adenomatous change, but the enlarged lobe was jammed behind the upper part of the sternum and the insertion of the sterno-mastoid muscles. In these cases, the dissection was necessarily very deep, and the traction on the lobe, in order to bring it to the surface, very considerable. These cases tested the local analgesia in the fullest degree.

Case 22, which was the most severe test of all, calls for some special notice for several reasons. It was that of a young gentleman of 16, sent to me by Dr. O. Wood of Woolpit, Suffolk. Two of the patient's elder brothers had had similar thyroid enlargements, which had not been operated on, and both had died of sudden dyspnœa within a few minutes. This naturally alarmed the parents as to the third son, when both lobes of the thyroid began to enlarge, and the breathing became seriously affected. All the usual remedies were tried by Dr. Wood without any permanent benefit before he was brought to me. There was at this time considerable alterations of the voice and stridor. Both lobes of the thyroid were enlarged, the left being most so. It was about the size of the fist, and lay very deep, its lower border being caught behind the sternum, and it appeared unusually hard. Infiltration was done as above, and the usual curved incision made about three-quarters of an hour later. It was found, on exposing the left lobe, that it was generally enlarged by adenomatous degeneration, and very dense. There was nothing for it but to remove it entire. The deep separation of the lobe gave rise to a feeling of great "*pressure*" on the air passages, distressing to the lad, and I asked him would he like chloroform. This he declined, and the lobe was soon dislocated forwards to his great relief. The isthmus was then divided with scissors, snip by snip, and the thyroid vessels secured. After this there was no trouble, and the wound healed *per primam*. In this case, I should have had great fear of a general anæsthetic, remembering the history of the two elder brothers. And although there was a short period of a sensation of considerable pressure on the trachea (although traction was being made and not pressure), and the boy said he was very hot, this was amply compensated for by the avoidance of risk and the absence of vomiting after. This vomiting, which so frequently follows general anæsthesia, is very apt to cause bleeding into the wound, from the congestion due to straining, and the movements of the muscles around the area of operation consequent on the latter. This case encouraged me to proceed on the same lines on other cases almost as difficult.

Fourteen of these cases were operated on under local analgesia alone, and two more under local, until near the end of the procedure, when a little chloroform was added for a short time during the dislocation forwards of the large mass. Cases 4 and 17. In two, chloroform alone was employed, in the remainder, the notes are silent on this point. These were among the earlier cases of the list, and would now be within the reach of a local anæsthetic properly injected.

In every one of these cases, union took place without a flaw, and, in most, without any drainage. It may be noted too that hardly any ligatures were employed.

With ordinary dress, the scar of Kocher's incision can hardly be seen at all, and there is no puckering of the neck, which is not uncommon where mesial or lateral incisions have been made, as was the case in some of my earliest excisions.

THE DIAGNOSIS OF CHRONIC VALVULAR DISEASE OF THE HEART.

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LESIONS of the aortic and mitral valves will alone be considered in this article. Tricuspid lesions are rarely met with apart from mitral disease, whilst affections of the pulmonary valve are almost invariably congenital in origin, and, when all the attendant conditions are taken into consideration, the diagnosis of the existence of congenital heart disease is seldom difficult, although it is commonly impossible to decide exactly what defects actually exist. To distinguish between the different lesions, which may be present at the aortic and mitral orifices, is frequently by no means an easy matter, and, consequently, the observer is very apt to forget that the recognition of obstruction, or incompetence, or even of both together, at one or more of the cardiac orifices, is merely the first step towards a full and accurate diagnosis, and that, in order to be in a position to give a reasonably good prognosis, and to advise as to the most suitable lines of treatment, it is necessary also to ascertain, if possible, the cause of the lesion, its severity, and whether or no compensation is satisfactory. Each of these diagnostic problems calls for separate and detailed consideration.

I. *What Valve or Valves are affected, and is the Lesion Obstructive or Regurgitant, or both combined?*—These questions have to be answered by deductions drawn from the results of the familiar methods of physical examination, viz., from the presence of a murmur (sometimes with an accompanying thrill), its time in the cardiac cycle, the place where it is best heard, the lines along which it is conducted, and, to some extent, from its character. In many cases the pulse is of great assistance; for instance, in aortic regurgitation the visible and water-hammer pulse may be practically pathognomonic of the lesion, even though the murmur be very indistinctly heard.

So far it is merely a question of careful physical examination, but several possible fallacies have to be considered, for, on the one hand, there may be no murmur, even when a valvular affection is present, and, on the other hand, the murmurs of valvular disease are frequently simulated, that is to say, a bruit even of endocardial origin may be due to some entirely different cause than a lesion of a valve. Murmurs of mitral origin are particularly prone to disappear towards the end of the disease, as the heart's action becomes feebler, and thus in the most serious cases, especially of mitral stenosis, no murmur whatever may be audible. Mitral obstruction may not give rise to a murmur, even in its earlier stages; there may be merely a reduplication (or what sounds like a reduplication) of the second sound at the apex, or the murmur may be heard only when the heart is acting forcibly; for instance, a man, when examined in the out-patient room, may have a typical rough presystolic bruit, but, if he is admitted to the ward, this may entirely disappear by the next day, as a result of a few hours' rest in bed, although any moderate exertion may suffice to render it temporarily audible again. Some mitral regurgitant murmurs can only be heard when the patient is recumbent, and, in the later stages of double mitral disease, the frequent variations in the murmurs are notorious. Broadbent suggests that the high pressure maintained in the left auricle by the hypertrophied right ventricle may, for a time, prevent regurgitation, so that a presystolic murmur only is heard, but that, when the right ventricle fails, and the pressure in the left auricle consequently falls, a regurgitant or systolic murmur develops, whilst the presystolic disappears. Aortic murmurs are less uncertain, although occasionally the bruit of aortic incompetence may only be audible between the third and fifth cartilages to the left of the sternum, and sometimes, in the later stages of aortic disease, the characteristic murmurs may become very faint, or be even completely lost.

Turning to the simulation of murmurs, the distinctions between pericardial and endocardial sounds have of course to be considered, but it is unnecessary here to enumerate the special characters of each, as they are sufficiently set forth in the ordinary text-books. The only valvular murmur, which is rarely, if ever, simulated at all closely by any other of endocardial origin, is that of aortic regurgitation, for a murmur diastolic in time, heard at the base of the heart and down the sternum, and not due to pericardial friction, can only be caused by aortic incompetence. Pulmonary regurgitation, which theoretically might give rise to a similar murmur, is so rare as hardly to call for consideration. On the other hand, the corresponding systolic bruit at the base of the heart comparatively seldom indicates real aortic stenosis; sometimes it is due to anæmia, although then usually louder in the pulmonary than in the aortic area, very occasionally to a displacement of the heart, sometimes to a slight dilatation of the ascending part of the aorta, or even to actual aneurysmal dilatation here, but, most frequently of all, especially in later life, it is produced by roughening of the aortic cusps from atheromatous change. Doubtless there is some slight degree of obstruction, but commonly so little as to be negligible for all practical purposes. The real significance of the murmur in the latter case, lies in the fact that it indicates an atheromatous condition, not merely of the aortic cusps, but in all probability of the adjacent part of the aorta also, very likely with involvement and narrowing of the orifices of the coronary arteries, a condition, of course, of the utmost gravity. The existence of an appreciable degree of aortic stenosis is only to be inferred when, in addition to a systolic murmur, there is also a corresponding thrill in the aortic area (the possibility of aneurysm has to be excluded), and evidence of some hypertrophy of the left ventricle, together with the characteristic small, long, and infrequent pulse. It may be noted, too, that, if the aortic second sound is accentuated, there is probably no real stenosis. A systolic murmur is present, along with the diastolic, in most cases of aortic incompetence, but almost invariably the typical water-hammer pulse shows that there can be but little, if any, real obstruction, and post-mortem observations confirm this opinion.

Turning to mitral lesions, we find that not only, as already stated, is the characteristic presystolic murmur of mitral stenosis frequently absent, even when its cause exists, but that it is sometimes present in the absence of any obstruction; *e.g.*, in certain cases of aortic regurgitation (the so-called Flint's murmur), mitral regurgitation and adherent pericardium, in all of which conditions the left ventricle is dilated, so that the blood passes through the mitral orifice into a relatively wider space beyond, and thus the necessary condition for the production of a murmur exists. The presence of a distinct presystolic thrill at the apex is of great assistance in the diagnosis of genuine mitral stenosis, especially as a mere accentuated commencement to a systolic murmur, a sign of no special significance, is sometimes mistaken for a presystolic bruit.

A systolic murmur, heard most loudly at the apex of the heart, conducted more or less into the axilla, and often audible also in the inter-scapular region, is the commonest of all the endocardial murmurs, and is unlikely to be due to any other cause than mitral regurgitation. The murmur of tricuspid incompetence is most distinct near the ensiform cartilage, does not extend beyond the apex-beat, and is never heard over the back. The chief difficulty about mitral incompetence is to decide whether it is valvular or myocardial in origin, for whereas aortic regurgitation is nearly always due to actual disease of the valve, the corresponding mitral lesion frequently results from dilatation of the orifice or imperfect contraction of the muscle of the left ventricle, the flaps of the valve being perfectly healthy, but unable by themselves to close the opening. In many cases, it is hardly possible to say with certainty which condition is actually present. The existence of a presystolic along with the systolic bruit and an unmistakable history of rheumatic fever are very strongly in favour of valvular disease, whilst advancing life, or the presence of considerable anæmia, increases the probability that the murmur is due to muscle failure. It must be remembered that the two conditions are often combined; in fact, in all cases of failure of compensation in mitral incompetence, there is almost necessarily some element of muscular weakness, and consequent increase in the reflux. The regurgitation, due to the latter cause, may be removed by rest and suitable cardiac tonics, whilst that due to the disease of the valve itself is, of course, irremediable.

II. *What is the Cause of the Lesion?*—When the nature and situation of a cardiac valvular lesion have been settled, its cause has next to be investigated, and the most important practical question now is whether the lesion is rheumatic or degenerative. In a limited number of aortic cases, the possibility of a syphilitic origin has also to be considered, for when disease, limited to the aortic valve, occurs in a young adult, with no history of rheumatism or of any special strain, a causal syphilitic element should certainly be suspected. Such cases are, however, comparatively uncommon. As a general rule, a mitral lesion in a patient, under thirty years of age, may be regarded as, *ipso facto*, of rheumatic origin. The absence of any history of rheumatic joint affection matters nothing, for, when rheumatism attacks the heart during childhood, it is perhaps more often than not unattended by any obvious articular trouble, at any rate by any which is remembered in after years. After forty, and still more after fifty years of age, the cause of a valvular lesion is difficult to decide, in the absence of any definite history of rheumatism or chorea. To an increasing degree, it is likely to be degenerative, especially when the aortic valve is affected. It must, of course, be borne in mind that, in later life, degenerative changes are very prone to occur more or less prematurely in valves already damaged by rheumatism.

The cause of the valvular lesion is of the utmost importance in prognosis. Putting aside those cases, in which aortic disease is pretty directly connected with syphilis, and in which anti-syphilitic remedies, if given sufficiently early, may arrest the mischief, the all-important question as to whether the lesion is or is not progressive depends mainly upon whether it is rheumatic or degenerative. For the most part the former conditions are stationary, and the latter progressive.

To the general rule that rheumatic lesions do not tend to increase, apart from fresh rheumatic attacks, there are some apparent exceptions in childhood, but, even in these cases, the increasing damage to the heart is really due to recurrent sub-acute attacks of endocarditis, complicated sometimes by pericarditis and more or less involvement of the cardiac muscle. Furthermore, if the two mitral flaps become adherent along their free margins, the valve becomes one circular curtain, the inflammatory products in which, by undergoing progressive contraction, may give rise to an increasing degree of mitral constriction, exactly as a urethritis may start a progressive urethral stricture. Despite these exceptions, however, the general rule holds good that, when once a rheumatic attack has come to an end, no further damage to the cardiac valves will follow, although, of course, some considerable time —perhaps several months—must elapse before the possible secondary consequences of an acute endocarditis are complete, for organisation and contraction of the inflammatory products have to take place. Degenerative lesions, on the other hand, are, from their nature, necessarily progressive, and consequently the prognosis must from the first be exceedingly guarded, especially in the case of aortic lesions, for the root of the aorta is usually degenerate also, and the orifices of the coronary arteries very probably narrowed. Syphilitic lesions may be classed with degenerative ones, with the exception that, in the early stage, they are somewhat more amenable to treatment. The cause of the valvular lesion also influences to some extent the treatment when the heart begins to fail; for instance, digitalis may be given with much greater safety and probability of benefit, when compensation is failing in the rheumatic variety of aortic disease, than when the lesion is of the arterial or degenerative type.

III. *What is the Severity of the Lesion ?*—In other words, to what extent is the affected valve damaged ? Is the obstruction, or the incompetence, as the case may be, comparatively trivial, or is it really considerable ? The answer to this important question is determined mainly by the size of the heart, that is, by the amount of enlargement to which the valvular lesion has given rise. In rheumatic cases, however, it is of the utmost importance not to venture upon any definite estimate of the damage done, until at least six months have elapsed since the rheumatic attack, in order to allow adequate time for the development of the secondary fibroid and contractile changes, following upon the endocarditis, and for the necessary compensatory changes in the cardiac cavities. Sometimes it actually happens that, during, and, for a little time after, an attack of rheumatic fever, no murmur is audible, although subsequently, even in the entire absence of any further rheumatic manifestation, a permanent bruit gradually develops.

It must be clearly understood that there is no necessary relation between the loudness of a murmur, and the severity of the lesion giving rise to it ; as a general rule, a loud murmur is a good sign, as it indicates a vigorously acting heart, whilst conversely a feeble murmur suggests an imperfectly contracting heart ; certainly the gradual disappearance of a previously loud murmur, unless accompanied by other indications of improvement, is usually of the gravest significance. Nor does the conduction of a murmur help materially. If other indications are favourable, the fact that the murmur of mitral regurgitation is not well conducted into the axilla suggests that the incompetence is not very marked. In aortic disease, especially regurgitation, the characters of the pulse, taken in conjunction with the size of the left ventricle, give a very fair indication of the severity of the lesion, and Broadbent also lays stress upon the absence of the second sound in the neck, over the carotid artery, as indicative of a considerable degree of incompetence. In the great majority of cases of aortic disease, there is a double murmur, and then the question, whether the obstructive or the regurgitant lesion is the more serious, is determined mainly by the characters of the pulse ; as already stated, incompetence predominates in the vast majority of instances, and the pulse has the typical water-hammer character. Theoretically, if both lesions are well marked, the special pulse characters must more or less neutralise each other, but experience shows that this rarely happens. In cases of mitral incompetence, both ventricles are enlarged in proportion to the severity of the lesion, but the change in the right is the more marked, and considerable pulsation at the epigastrium, provided the effects of excitement and of recent exertion are excluded, and, still more, pulsation and dulness to the right of the sternum are evidences that greatly increased work is thrown upon the right ventricle. In uncomplicated mitral stenosis, the right ventricle alone suffers, and consequently the enlargement of the heart is not so pronounced, but important evidence of a severe lesion is afforded by a fine thrill, a small pulse, and by enlargement of the liver. Accentuation of the second sound in the pulmonary area is often present in mitral disease from an early stage, but does not necessarily indicate that the mischief is at all serious.

When both the mitral and the aortic valves are affected, the predominance of enlargement of the right or left ventricle respectively will determine which valve is the more damaged A difficult point often to settle is whether the mitral lesion is entirely secondary to the aortic, or whether it has arisen separately. In such cases, it is helpful to ascertain the cause of the mischief; if it is rheumatic, it is probable that each valve has been attacked independently, whereas, if the lesion is purely degenerative, it is most likely that any mitral disease present (especially if only regurgitant) is secondary to the aortic, and myocardial rather than valvular in origin.

IV. *Is the Lesion properly compensated ?*—This is the last point to be settled, and the answer decides whether immediate treatment is or is not required, for, as a general rule, so long as compensation is satisfactory, only precautionary measures are needed. It is important to note that there is no necessary connection between the severity of a valvular lesion and the adequacy, or otherwise, of compensation, although, of course, other things being equal, the more serious the lesion the sooner is failure of compensation likely to occur. Nevertheless, provided the cardiac muscle remains healthy, compensation may for many years continue to be satisfactory for valvular lesions of even the most serious character, and resulting in great enlargement of the heart. On the other hand, failure of compensation may occur when there is no evidence of extensive valvular disease; it may be due to some intercurrent condition, such as anæmia, influenza, or mental worry, or—what is more serious—to a degenerative lesion which is not limited to the valve. For instance, a man about fifty years of age, with no history of rheumatism, develops signs of aortic incompetence; the enlargement of the heart is but slight, the pulse characters not at all typical, and the amount of regurgitation, therefore, probably trivial. Nevertheless the patient complains of a good deal of dyspnœa, of occasional tendency to faintness, and of more or less severe attacks of precordial pain, all these symptoms indicating that slight though the damage to the valve may be, yet compensation is unsatisfactory, and the danger of a sudden fatal termination very great. The explanation is that the valvular lesion is merely part of an extensive atheromatous process at the root of the aorta, which narrows the coronary arteries, and deprives the ventricular muscle of an adequate supply of blood, just when, for purposes of compensation, it needs an extra quantity. In fact, it is probable that really satisfactory compensation is never established in the case of degenerative lesions at the aortic orifice.

The answer, therefore, to the question, whether a valvular lesion is properly compensated, depends partly upon symptoms, and partly upon physical signs, and the former are the more important. The most significant symptom of failing compensation, especially in cases of mitral disease, is dyspnœa. Some explanation, however, of this general statement is necessary. Every valvular lesion, however slight, must give rise to some undue shortness of breath on exertion, otherwise we should arrive at the *reductio ad absurdum* that a damaged heart is as functionally efficient as a perfectly healthy one. The process of compensation uses up some of the reserve force of the heart, so that dyspnœa more readily follows any exertion, especially going uphill or upstairs. The more considerable the compensation, the more readily is dyspnœa produced, for the less reserve has the heart to draw upon ; consequently the readiness with which it occurs may, to a certain extent, be regarded as an indication of the severity of a valvular lesion, provided that the patient is otherwise healthy. When, however, dyspnœa becomes progressive, when it is noticeable even whilst the patient is walking quietly on the level, still more when it passes into orthopnœa, then it is clear that compensation is distinctly failing. Cough and attacks of hæmoptysis afford additional evidence, especially in cases of mitral obstruction ; still it is remarkable how often such patients suffer from repeated slight attacks of hæmoptysis, without further development of serious symptoms ; perhaps the occurrence of hæmorrhage is a sufficiently alarming symptom to at once lead them to remain absolutely at rest, and thus allow compensation to be regained. In cases of aortic disease, sub-sternal oppression and pain, culminating in definite anginal or syncopal attacks, are important indications of heart failure.

Turning to the physical signs of failing compensation, we find that these tend to lag somewhat behind the symptoms and consequently do not afford so trustworthy an indication as the latter of commencing cardiac breakdown, just as is the case with tuberculous lung disease. It is, too, most important to bear in mind how much the co-existence of emphysema interferes with the physical examination of the heart, especially with percussion, and, in cases of degenerative heart disease, emphysema is unfortunately particularly prone to be present. Nevertheless physical signs may give important evidence that compensation is no longer satisfactory; there is, for instance, the marked difference between the well-defined thrust or heave of a hypertrophied and strongly acting ventricle, and the diffuse flapping impulse, with no definite point of maximum intensity, of the ventricle in which dilatation predominates. Naturally, the larger the heart the greater the force needed to empty its cavities, and the more vigorous should be the impulse; hence if, as a result of enlargement of the heart, the apex-beat is displaced, without any increase in its strength, the presumption is that there is relative weakness for the work the heart has to do; in other words, that compensation is insufficient, unless indeed there is the complication of overlapping lung. The gradual weakening and final disappearance of the apex-beat have the same evil significance as the gradual disappearance of a murmur. In cases of mitral disease, a well-marked accentuation of the second sound in the pulmonary area is a favourable sign, as it indicates that the right ventricle is acting sufficiently strongly to maintain high tension in the pulmonary circulation; the converse is, of course, true if the accentuation diminishes. In the later stages of left ventricle failure, the first sound at the apex (when not obscured by a murmur) tends to lose its distinctive character, becoming short and toneless, more or less like the second sound, and Broadbent has pointed out the bad significance of an approximation of the two sounds, as indicative of a shortened and incomplete ventricular systole.

It need hardly be said that such definite indications of back pressure and failure of the right ventricle, as signs of congestion of the pulmonary bases, and still more the development of fulness and pulsation of the jugulars, enlargement of the liver, œdema of the legs, etc., point to a complete breakdown in compensation, for which absolute rest and other suitable methods of treatment are urgently indicated. A question, which often arises in connection with symptoms of failing compensation, and one of great importance in prognosis, is whether the breakdown is due to simple overstrain and exhaustion of the heart, and is therefore capable of being recovered from, or whether it depends upon definite and irremediable organic changes—fatty and fibroid—in the myocardium. The condition of the patient's other organs, so far as is determinable by physical examination, his age, and his family history, as affording evidence of marked vitality or otherwise, may help in forming an opinion, but, very often, only the results of suitable treatment will finally decide which condition is actually present.

It is noteworthy that, in children, mitral disease often progresses to a fatal termination without the development of marked back-pressure symptoms, the seriousness of the condition being indicated only by increasing weakness, anæmia, wasting, and dyspnœa, with little or no dropsy, cyanosis, or even irregularity of the pulse. In many such cases, adherent pericardium is also present ; in fact, whenever, in connection with heart disease in children or young adults, symptoms of failing compensation develop, for which the valvular lesion alone seems inadequate to account, the possibility of adherent pericardium should be considered. The ordinary signs of this condition, as enumerated in books, apply mainly, if not exclusively, to adhesions between the pericardium and the chest wall, that is, to mediastino-pericarditis, but certainly in children with mitral, but no evidence of aortic, disease, and a heart so greatly dilated as to give rise to well-marked precordial bulging, there is a very considerable probability that the pericardial sac is obliterated, although this is quite undiagnosable by definite physical signs, and no history of pericarditis may be obtainable. Another feature to look for in all cases of heart disease in children is the presence of subcutaneous rheumatic nodules, as these almost invariably indicate the existence of active heart mischief.

It is, of course, mainly for purposes of prognosis and treatment that we seek to attain the greatest possible accuracy in diagnosis, and, whenever any particular case of chronic valvular disease has been investigated on the lines indicated above, when not merely has the nature of the lesion present been determined, but also its cause, and whether or no it is likely to be progressive, its severity, and, finally, if it is satisfactorily compensated, then, and not until then, is the observer in a position to give a reasonably accurate prognosis, based on adequate data, and to decide what kind of treatment, if any, it is desirable to adopt.

ON DISPLACEMENT OF THE INTERNAL SEMILUNAR CARTILAGE OF THE KNEE-JOINT.

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[With Plates IX.—X.]

THE knee-joint derives its strength, not from the shape of the articular ends of the bones, which enter into its formation, but from the muscles and ligaments which surround it. This peculiar formation of the joint, and the great stress and strain which it has to withstand, render it more liable to derangement than any other joint in the body, and there can be no question that the internal semilunar cartilage is more prone to injury than any of the other constituents of the joint.

A complete description of the cartilages is quite beyond the scope of this paper, but it is necessary to lay stress on some of the more important points which bear on the question.

The semilunar cartilages may be regarded as the remnants of two complete inter-articular discs between the femoral condyles and the upper surface of the tibia, the inner and central portions of which have become worn away in the process of time, with the result that a sharp edge projects towards the tibial spines, whilst the peripheral portions retain more or less their original thickness. This wearing-away process has progressed to a greater extent on the inner side as the result of the greater strain on that part of the joint, so that the internal semilunar always leaves a greater area of the tibia exposed than is the case with regard to the external cartilage, which, in certain rare cases, exists as a complete disc. The anterior half of the internal cartilage has also suffered more than the posterior part, and is consequently always narrower from side to side.

The two cartilages are attached by their extremities in the following manner. The anterior cornu of the internal cartilage is attached in front of the internal spine of the tibia, immediately in front of the anterior crucial ligament, whilst the posterior extremity is bound down to the tibia in front of the posterior crucial ligament but behind the internal spine ot the tibia.

The anterior cornu of the external cartilage is attached in front of the outer tibial spine, behind and to the outer side of the anterior crucial ligament, whilst the posterior extremity is fixed to the rough impression that lies between the two tibial spines, in front and to the outer side of the attachment of the internal semilunar.

As regards the relative strength of the cornual attachments, the posterior horns of both cartilages are firmly bound down to the tibia, and the external cartilage receives, in addition, a strong reinforcing band from the posterior crucial ligament. So firm indeed are these posterior attachments that it is doubtful if the cartilages are ever torn away from their posterior points of fixation.

The anterior cornu of the external cartilage is also firmly bound down to the tibia. On the other hand, the anterior extremity of the internal cartilage varies greatly in its exact mode and strength of attachment. In some cases, the tip of the cartilage is distinctly attenuated, and the band that fixes it to the tibia correspondingly diminished in size. In other cases, the cartilage is not attached to the tibia at all, but is prolonged across to the opposite cartilage as part of the transverse ligament, a structure that normally unites the anterior portions of the two cartilages.

On pure anatomical grounds, therefore, it would be expected that the anterior part of the internal semilunar would be more liable to displacement than any other part of either cartilage.

On examining the main body of the cartilages, it will be seen that each is bound down to the upper and outer margin of the tibia by a fairly strong band of fibres, known as the "coronary ligaments." The internal cartilage also receives, in addition, fibres from the broad internal lateral ligament of the joint, whilst the external semilunar is separated from the long external lateral ligament by the popliteus tendon, a tendon which normally grooves the cartilage, and aids in the maintenance of its position.

In rare instances, the cartilages may be torn away from their peripheral coronary and ligamentous attachments, whilst still retaining intact their cornual points of fixation, the body of the cartilage being usually displaced inwards towards the spines of the tibia, and occupying the region of the inter-condyloid notch of the femur.

The only common form of displacement, however, is that in which the anterior part of the internal cartilage is torn away from its tibial attachment, or from the transverse ligament, occupying any position between the two extremes of outward projection towards the triangular space that lies on the inner side of the joint between the patella, femur, and tibia, and that of inward dislocation into the inter-condyloid notch. Most commonly, the floating end of the cartilage occupies a position intermediate between these two extremes, and is consequently liable to be nipped between the two bones at any moment.

Under such conditions, the detached portion becomes fibrous, bulbous, and incompletely fractured from the fixed posterior segment, whilst the more free the movements are, the greater is the tendency for the detached portion to be completely fractured, and to be set free as a loose body in the joint-cavity.

The actual detachment of the cartilage usually takes place during the carrying out of some violent form of exercise, during which the body is twisted violently to one side, whilst the leg remains firmly planted on the ground. As a result of this, the femur is forcibly rotated inwards on the tibia, and the internal condyle, coming into sudden and violent contact with the anterior part of the internal semilunar, tears it away from its tibial or other attachment.

In the subsequent attacks, the detached portion is nipped between the two bones before it has time to be displaced to some safe position.

As the result of the sudden displacement of the cartilage, the patient experiences acute pain in the joint, so acute indeed that he often falls to the ground, whilst, if the cartilage remains nipped between the bones, the limb remains flexed or "locked" in the slightly flexed position. After a few attempts at straightening the limb, or as the result of such attempts on the part of bystanders, the cartilage slips out of its constrained position, the leg is able to be again fully extended, and the patient either limps or is assisted home. Within a few hours, effusion takes place into the joint, sometimes of so severe a nature that the sufferer is confined to bed for some weeks. The fluid, however, usually subsides in about two or three weeks. The patient then gets about, returns to his ordinary vocation, and may be exempt from any further trouble in the joint. As a general rule, however, it can be stated that a cartilage, once displaced, usually leads to further attacks, and that these attacks occur on the slightest provocation, and at the most inconvenient moments.

There is also reason to believe that the recurrent attacks of acute, or subacute, synovitis render the joint more prone to the development, at a later date, of osteo-arthritic changes.

Treatment of the First Attack.—(*a*) The reduction of the fixed cartilage.—The patient should lie flat on his back, and should be instructed to grasp firmly with both hands the fully flexed thigh, whilst the surgeon, standing on the outer side of the affected limb, grasps the condylar region with the one hand and the malleolar region with the other, and, steadying the thigh with his own, fully abducts the leg on the thigh so as to increase, so much as possible, the space between the inner articular surfaces of the femur and tibia. The tibia is then rotated, both inwards and outwards, and finally fully extended on the thigh, the limb being brought down as the extension is increased. At some time during the course of these manipulations, the cartilage slips, often with a definite click, out of its constrained position.

If these attempts are fruitless, the manipulations may be repeated under an anæsthetic. If all attempts are useless, it will become necessary to cut down on the cartilage and remove it. The details of operation are identical with those enumerated later.

(*b*) The subsequent treatment.—The patient must be confined to bed for at least a week, during which time the limb should be placed on a pillow in the flexed position, and the region of the knee covered with an ice-bag or some cooling lotion. At the end of the week, the whole limb, and especially the knee-region, should be massaged every other day, and passive movements instituted daily in order to maintain the tone of the muscles, to reduce the effusion, and to prevent the formation of any adhesions. As soon as the effusion shows marked subsidence, the patient may get up and indulge in very gentle exercise, the knee being firmly bandaged. The bandage in itself is of but little use in preventing any further displacement, but it limits the movements of the joint, and supplies the patient with that degree of confidence which is so necessary for the utilisation of the affected limb.

Treatment of Recurrent Cases.—The general inconvenience of a loose cartilage, the non-reliability of the joint, and the possible later development of osteo-arthritis, all urgently point to the necessity of weighing carefully the relative advantages of the only two forms of treatment available—instrumental and operative. In order to determine, however, whether any subsequent treatment at all is needed, it is necessary to see if further developments are going to take place or not, and, in order to fulfil this object, it is advisable to allow the patient to go about his ordinary vocation without wearing any apparatus beyond the utilisation of a bandage or elastic knee-cap. By adopting this course, it will soon become apparent whether the loose cartilage is going to cause further trouble or not.

(*a*) *Instrumental Treatment.*—The tendency to recurrent attacks can be controlled, and in some cases prevented, by the adoption of a mechanical apparatus which, consisting in the main of lateral knee-irons with transverse connecting straps, interferes but little with the extension and flexion of the joint, but limits or prevents any act of rotation of the tibia on the femur. Such mechanical appliances present, however, certain grave disadvantages, being cumbersome, expensive, and always liable to get out of order. Furthermore, it will be necessary to wear the apparatus for a prolonged period of time, possibly for years.

(*b*) *Operative Treatment.*—It can be stated at once that all attempts at sewing down the detached cartilage are doomed to failure, that it is necessary to remove the affected portion only, and that the removal in no way interferes with the future utility of the joint.

Success hinges on three main factors:—

Absolute cleanliness.
Advoidance of hæmorrhage into the joint.
Early massage and passive movements.

In order to aid in the maintenance of cleanliness, it is

PLATE IX.

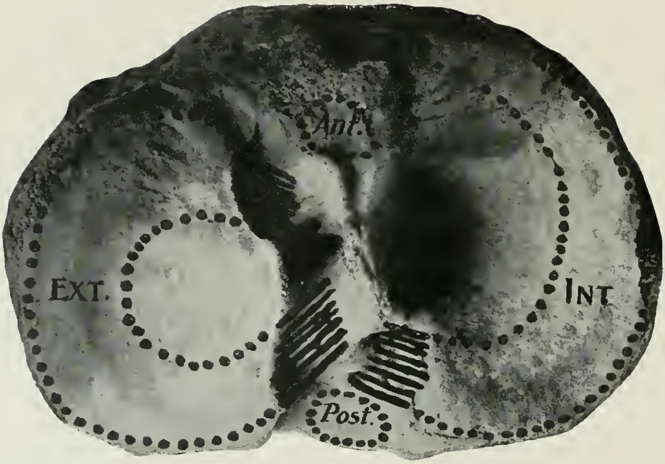

Fig. 1.—*To illustrate the attachment of the two semilunar cartilages, and that of the anterior and posterior crucial ligaments, to the head of the tibia.* INT. *and* EXT. *represent the two semilunar cartilages and their attachment.* ANT. *and* POST. *represent the site of attachment of the two crucial ligaments.*

advisable that the patient should be confined to the house for two days previous to the operation, during which time the region of the knee must be continuously fomented for the purpose of softening the thick skin in front of the patella, and of aiding in the further sterilisation on the night before the operation. The adjacent region must be shaved. At the operation the surgeon should wear rubber gloves, as digital exploration of the joint may be indicated, and every possible source of infection must be reduced to a minimum.

At the operation, the limb should be enveloped in sterilised towels in such a manner as to leave the smallest area exposed as is compatible with the details of the operation. The surgeon stands on the outer side of the limb, which is placed, in the slightly-flexed position, on its external aspect. An incision is made over the internal aspect of the knee, either curved or vertical. The curved incision presents certain advantages as it not only affords a better exposure of the parts, but also carries the line of the skin incision away from that into the joint, and so again reduces the chance of infection of the joint. This incision is carried from the most prominent point on the internal condyle of the femur forwards towards the inner margin of the patella, and then backwards to the tuberosity of the tibia. The imaginary base of the incision has its centre opposite to the joint-line. It is important not to mistake the groove immediately above the articular margin of the femur for the joint-line.

The skin-flap is dissected back to its base, and all bleeding points clipped and tied at once. A pair of forceps attached to the flap acts as a convenient retractor. The exposed lateral ligament is incised, in the vertical direction, about midway between the base of the skin-flap and the inner margin of the patella. Some surgeons prefer to incise the lateral ligament in the transverse direction, parallel to the line of the cartilage, a method which undoubtedly gives a better view of the cartilage in particular, and of the joint in general, but one which lays itself open to a great objection. The strength of the joint depends on the integrity of the surrounding ligaments, and, when the internal lateral ligament is incised in the transverse direction, there is some danger of the "giving" of the scar, and the consequent serious weakening of the joint.

Furthermore, the vertical incision will usually give sufficient exposure, if the margins of the cut ligament are dissected up, both in front and behind, from the underlying synovial membrane. (*See* Fig. 2.)

During this stage of the operation, certain branches of the superior and inferior articular arteries will probably be wounded. All these vessels must be clipped and tied at once. The synovial membrane is then picked up with a pair of forceps, and also divided in the same vertical direction, the joint-cavity being first exposed above the level of the cartilage. The condition of the joint and cartilage can now be thoroughly investigated. If the anterior part of the semilunar is detached, the bulbous end should be seized, drawn well out of the wound, and cut away. If, on the other hand, the semilunar is torn away from its peripheral ligamentous and coronary attachments, but still retains intact its tibial points of fixation, then it is necessary to remove the entire cartilage, the tibial attachments being snipped through with a pair of scissors. This complete detachment of the cartilage is of comparatively rare occurrence, and, in order to obtain sufficient room, it may be necessary to split the lateral ligament in the backward direction, parallel to and immediately above the line of the cartilage. This course must, however, be avoided unless absolutely necessary. If such a course is adopted, it is advisable to put a pair of clips at each corner of the cut ligament, in order to secure later the exact apposition of the ligament. (*See* Fig. 3.)

If the internal cartilage is apparently normal in every respect, the condition of the front part of the external semilunar may, in favourable cases, be inspected through the same incision, and the cartilage removed, if found at fault.

If both cartilages are normal, it will be necessary to fully explore the joint with the gloved finger in order not to overlook any loose body or hypertrophied fringe of synovial membrane.

If no cause is found, the question at once arises as to whether it is advisable to incise the joint on the outer side in order to more fully explore the condition of the external semilunar. In my opinion, such a course is most inadvisable. The risk is doubled, and, in the majority of cases, the state of

PLATE X.

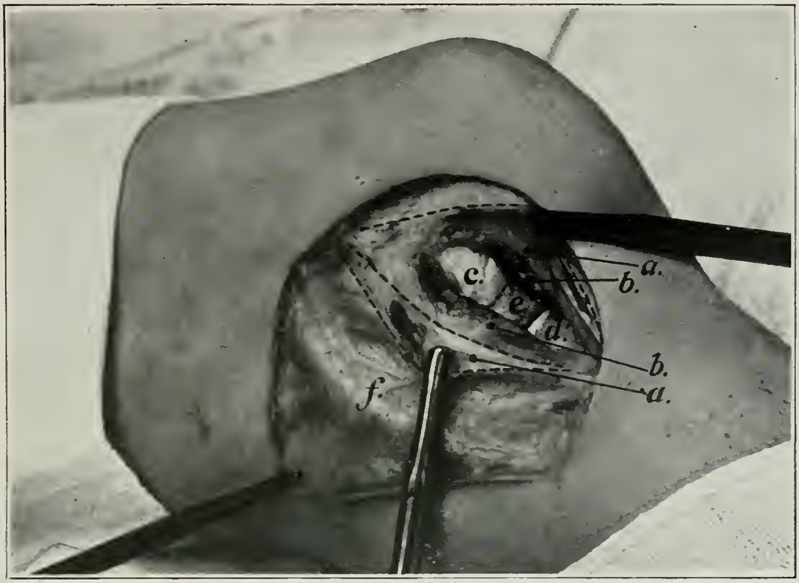

Fig. 2.—*To illustrate the exposure of the anterior part of the internal semilunar cartilage by the curved skin incision and the vertical incision through the internal lateral ligament and synovial membrane.* a, a. *The internal lateral ligament turned back and freed from the synovial membrane beneath.* b, b. *The margins of the divided synovial membrane.* c. *The femur.* d. *The tibia.* e. *The internal semilunar cartilage.* f. *The skin-flap.*

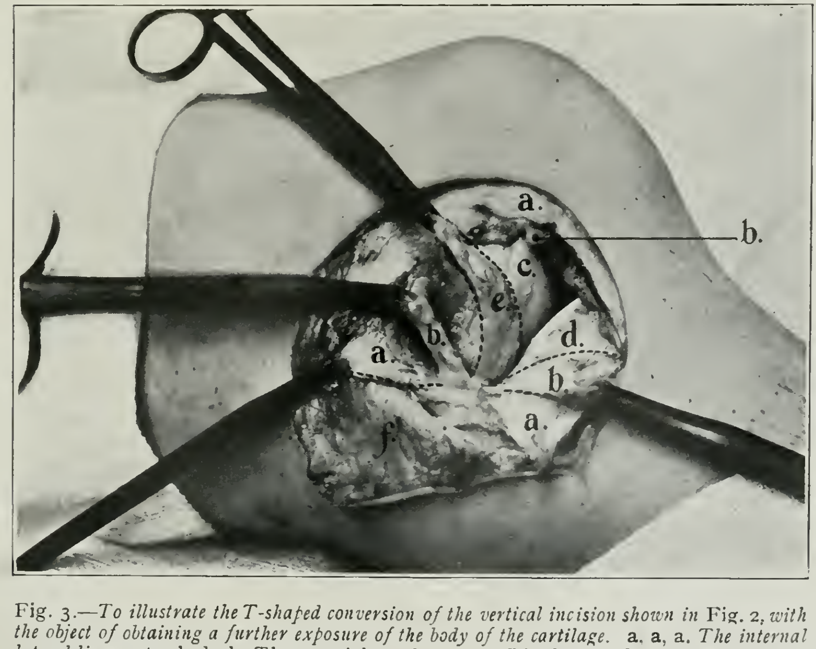

Fig. 3.—*To illustrate the T-shaped conversion of the vertical incision shown in* Fig. 2, *with the object of obtaining a further exposure of the body of the cartilage.* a, a, a. *The internal lateral ligament.* b, b, b. *The synovial membrane.* c. *The femur.* d. *The tibia.* e. *The detached cartilage.* f. *The skin-flap.*

the external cartilage can be sufficiently investigated from the original incision.

Before finally sewing up the wound, the joint must be thoroughly sponged out in order to remove all blood that may have found its way into the joint. The synovial membrane and the lateral ligament are sewn up in turn with catgut, and the skin with salmon-gut.

A drainage-tube is not only quite unnecessary, but adds appreciably to the risk of infection.

The limb may either be placed on a back-splint, or merely rest on a couple of pillows in the slightly flexed position. The latter course is usually more satisfactory to the patient.

The dressings remain undisturbed till the seventh day, when the stitches are removed, and the wound covered up with a piece of sterilised gauze soaked in collodion. The joint is then moved gently to and fro, in order to break down any slight adhesions that may have formed, and the knee lightly bandaged up to prevent the patient infecting the wound with his fingers. It is by no means uncommon for the joint to be found slightly swollen at the time when the stitches are removed, and this effusion may persist for some days afterwards. No anxiety need be entertained as to the ultimate result, if the subsequent treatment is carried out in a judicious manner.

In any case, systematic massage and passive movements of the joint must be instituted on the tenth day, the vigour of the massage and the extent of the movements being dependent on the condition of the joint. In other words, the greater the effusion, the more gentle the manipulations. This after-treatment is carried out every other day until the seventeenth day after the operation, and then daily for another week, at the end of which time the movements of the joint ought to be practically perfect in every respect. The patient can be allowed out of bed about the end of the second week, and can utilise the limb with gentle exercise during the third week. On no account, however, must any strenuous form of exercise be undertaken for at least six months after the operation.

The results obtained by operation are excellent, and it is quite exceptional for the patient to be anything but completely satisfied with the strength and general utility of the limb.

SOME REMARKS ON INGUINAL HERNIA IN CHILDREN: BASED ON AN EXPERIENCE OF 126 CASES SUBMITTED TO OPERATION.

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ALTHOUGH all varieties of herniæ have been recorded in the child, the inguinal type is of far greater frequency than all others, and hence of more interest to the surgeon. Femoral hernia is rare in children, yet many cases are recorded. Obturator and sciatic herniæ are curiosities. Umbilical hernia, as is well known, occurs with some frequency in the child. Two distinct types are seen, viz.: (1) congenital, (2) infantile. The congenital variety, on account of frequently associated deformities, its large size, and its demand for an operation shortly after birth, is frequently a fatal malformation. The infantile type is generally treated by the expectant method with some form of retentive apparatus, and cures are almost invariably reported as obtained by this form of treatment. Perhaps it may be a little dogmatic to use the word "cure" in this connection. A "cure" means a complete disappearance of the hernial sac, a complete indrawing of the peritoneal pouch, and a firm cicatrisation over it. It is a significant fact that this hernia is not seen in elder children, compared with its frequency in the infant. On the other hand, it is not quite easy to understand how this pouch can completely recede in some of the infantile herniæ which are of comparatively large size. A firm cicatrix may form over the peritoneal protrusion which effectually prevents the prolapse of abdominal contents. Should an incomplete recession of the peritoneum remain, it is easy to see how this would form the starting point of an umbilical hernia in the adult—the so-called acquired umbilical hernia—when the abdominal walls are stretched and weakened by intra-abdominal pressure. Clinical evidence, so far as I know, is wanting in support of this theory, and, at the present day, the infantile umbilical hernia, treated by the simple method, takes quite a subordinate place in the interest of the surgeon. Every surgeon connected with a children's hospital is well aware of the frequency of the inguinal type of hernia, yet there are points, bearing upon its ætiology and treatment, upon which all are not agreed. In this paper, it is my intention to draw some conclusions, from a personal experience only, of operations upon 126 cases. These do not include cases of imperfect descent of the testicle.

Inguinal herniæ are divided into two varieties, viz., the *direct* and *indirect*. I have not seen a marked case of direct hernia in the child. In older children a slight "bulge" of the posterior wall of the canal may occasionally be seen at the operation, as in the adult, but this is unusual, and, in my series, has never amounted to what might be called a hernia. It is only seen after division of the external oblique. Other herniographers appear not to mention this type in the child.

A marked case of interstitial hernia, not associated with imperfect descent of the testicle, I have not seen, yet such a case is recorded. For instance, Greene-Crunston has recently reported a case of interparietal hernia in a girl of nine years of age.

My experience is limited, therefore, to the indirect type of inguinal hernia. Of this many varieties are usually described in text-books. A broad classification often made is to divide such herniæ into (1) *congenital* and (2) *acquired*, according to the ætiology of the sac. It may seem that, from the point of view of treatment, it is not of much importance to draw any distinction between the types of herniæ. But it appears to me of the utmost importance, before attempting the treatment of any condition, that one should thoroughly understand the underlying pathological conditions. In order to have an acquired sac, some weakness of the abdominal muscles must be present. This condition of the abdominal muscles is insufficient to withstand the intra-abdominal pressure, and consequently a peritoneal bulge will occur at the weakened spot. Whilst operating upon these herniæ in children, one cannot fail to appreciate that there is no such weakness of the abdominal muscles in the majority of cases, the internal oblique being quite well developed. In large herniæ, or herniæ in older children, in whom the hernia frequently descends, quite true, there may appear to be some weakness and stretching of the lower fibres of the internal oblique. But this should be regarded as an effect of the hernia rather than the cause. A large hernial sac, more or less constantly occupied, would of necessity cause some thinning out of the muscles guarding the hernial orifice. There seems very little reason for supposing that a feebly-developed musculature is responsible for inguinal hernia in children. The knowledge of this fact explains the very satisfactory operative results. Should the condition depend upon primary muscular weakness, it is only to be expected that the hernia would recur after operation. This does not happen in children. As a further argument against the acquired nature of the sac may be mentioned the form and shape of the latter. In many cases, the most superficial examination of the sac will reveal its congenital origin. The sac is often irregular in its interior, sometimes showing almost complete septa, more often constrictions, flaps, or valves. Not infrequently, the sac is somewhat hour-glass in shape, or distinctly lobulated. All these appearances in the sac are obviously produced in one and the same way, viz., by attempted (but very imperfectly so) obliteration of a congenital processus vaginalis. The sac at the site of the internal ring is often very narrowed, as would be expected if it were of congenital origin, since this is one of the earliest places at which obliteration of the processus vaginalis takes place. This narrowness here is accountable for the comparative frequency of difficult reduction, or even strangulation. Even when such conditions of the sac are not obvious at a glance, stretching out the sac, and a little more careful examination of its interior, may reveal something of the sort which is sufficient to stamp the sac as one of congenital origin. It sometimes happens that no such peculiarities of the sac are seen. In such cases, the history of the case is of value in differentiating its type of sac. It is quite common to be told that the hernia, on its first appearance, was of large size, and completely distended the small scrotum, or formed a large swelling in the inguinal region. Such a history must mean a descent of abdominal contents into a preformed sac. It is quite a common experience to have some difficulty in obtaining the descent of the hernial contents. If the sac depended upon primary muscular weakness, it ought to be more or less constantly occupied, its neck not being sufficiently supported. Yet the child may be in hospital for some days, and no amount of straining movements will induce the descent of the hernia, although a hernia of large size had been seen down previously. On taking the cord between the finger and thumb, some thickening can often be appreciated ; this thickening is the empty sac.

For these reasons, there can be very little doubt that the hernial sac in the child is of the congenital variety, and this quite apart from the age of the child. If an older child is the patient, and has never been known to have had a hernia previously, or perhaps more likely the conditions in infancy have been forgotten, the history of the case, the size of the hernia, the muscular development, and the form of the sac will generally suffice to place the hernia in the category of those essentially dependent upon a congenital sac. Similar arguments apply to inguinal herniæ in adults, in whom there can be very little doubt that the majority depend upon congenital sacs.

Dismissing, therefore, the acquired herniæ as probably not occurring in children, all herniæ have, as their sac, the processus vaginalis in whole or in part. It seems that the time has arrived for some new nomenclature of herniæ in children. The most obvious classification appears to be :—(1) Sacs which consist of the whole of the processus vaginalis—*total funicular sacs ;* (2) Sacs which consist of only a portion of the processus vaginalis—*partial funicular sacs.* These two will, I think, comprise all varieties of herniæ met with in the child. The so-called *encysted* type of sac and its varieties can, I think, be explained by the relation of the partial funicular sac to the tunica vaginalis, the level of obliteration of the processus vaginalis, the development of the tunica vaginalis, and the subsequent growth and distension of the partial funicular sac. There is nothing mysterious about it, and it does not justify a separate classification. In minor degrees, it is not infrequently seen, but, in a very marked condition, it is not very common.

My series of 126 cases comprises 115 male and 11 female children.

In the 115 male cases, the sac was of the total funicular type only in 11, or nearly 10 per cent. In the 11 female cases, the sac was well developed in all save one, and probably, in the 10, was therefore of the total funicular type. My cases show no gross disproportion between the two inguinal regions affected.

TREATMENT.

Regarding these herniæ as depending on the presence of a congenital sac, it is difficult to believe that they can be cured in any other way than by removal of this sac. The effect of a truss upon these herniæ it is impossible to state. From the pathological side, I have never seen any case in which a truss has caused the slightest alteration in the sac. Many, perhaps the majority, of my cases have worn trusses for variable periods, and not in any case have I been able to detect any attempt at obliteration of the sac in any part. Its interior is, in all cases, perfectly smooth, free from adhesions of its walls, and perfectly patent. The trusses have been either the "wool" or "light spring" variety. From the clinical side, it is well known that quite frequently one hears of "cures" by this method of treatment. But are these cases "cures"? The fact that a hernia has not been noticed for some months or years is no guarantee of its cure. It is not very infrequent to be told that the boy had a hernia in infancy, and the rupture has only recently come back at the age of 2, 3, 4, or more years. Sometimes the hernia was not noticed in infancy, but only in later childhood, yet the sac is undoubtedly of congenital origin. Quite frequently a hernia appears for the first time in adolescence, or in adult life, and the sac is undoubtedly congenital. These herniæ, depending as they do on the presence of a congenital sac, and not on any primary weakness of the abdominal wall, may be retained indefinitely, and particularly so in cases in which the neck of the sac is very narrow, as it so frequently is.

The processus vaginalis should be separated from the abdominal cavity just before, or at the time, of birth. Presumably this may be delayed. If an infant is noticed to have a hernia shortly after birth, a truss, which effectually controls the hernia, and constantly prevents any escape of abdominal contents into the sac, may theoretically effect a cure. The cure, in such cases, would be brought about by natural means, the time of closure of the processus vaginalis being for some reason or other delayed. The truss only indirectly aids in this cure. It is highly improbable that nature will perform her work so late as some weeks, or months, after birth. It seems utterly futile to expect a cure from the truss in the majority of cases, especially in the hospital class of patients. The truss is only irregularly worn, it may be through carelessness, it may be through the tender condition of the infant's skin, or the truss breaks, or the child outgrows it, or other reasons: all spoil what slight chance there may be of gaining a cure. Each time the truss is removed, down comes the hernia, the truss is replaced in the fond hope that it is, in some subtle way, curing the "rupture." For three years, I have abandoned the truss entirely except in special cases. In these cases, I always warn the parents that the truss will not cure the rupture, with the possible exception that it may theoretically do so within the first few weeks of life. If a hernia has been seen after the first few weeks of life, the only cure is by operation. The hernia may be retained for weeks, months, or years, yet the sac is still there, but, at any time, the contents are liable to descend with unpleasant consequences, for it is, in such cases, that strangulation is not infrequently seen both in the infant and in the adult. Circumcision, the correction of diarrhœa, or of constipation, and the treatment of other conditions, from which the child may suffer, cannot possibly have any influence upon the cure of these herniæ.

Speaking generally, the earlier these herniæ are operated upon the better. They should be operated upon, when possible, in infancy, and not deferred until childhood, at which age an operation might seriously throw the child back in his scholastic life. The reluctance, with which these operations are approached at this tender age, is in part accounted for, no doubt, by the belief that infants do not stand these operations well, and that sepsis is very likely to result. This is erroneous. A baby, otherwise healthy, when it has reached the third or fourth month of life, will make a most satisfactory recovery from the operation, and, at this age, I should advise it, unless the operation entails weaning of the infant. In hospital practice, an operation at this age would generally mean weaning the baby, but, in private practice, it need not necessarily do so. In a breast-fed infant, I should defer the operation until the child is weaned, and is known to be thriving upon its new food, unless there is some special indication to the contrary. The indications for operating earlier in these cases are:—(1) strangulation; (2) two or three attempts at strangulation with difficult reduction; (3) large herniæ, which frequently mean cæcal herniæ, and are not retained by any truss; (4) any case of hernia, which cannot satisfactorily be prevented by any truss from descending. In any case, in which these conditions are absent, I consider it best to wait until after the infant is weaned: the child, of course, must be otherwise healthy. In a bottle-fed, healthy baby, the operation may be safely performed at the fourth month.

The operation for the cure of a hernia, in a young infant, is often a more difficult proceeding than when performed in later life. The recognition of the various tissues renders this so. The thickness of the subcutaneous fat on this region, the recognition of the thin external oblique and the spermatic cord, the delicate nature of the sac, and the general smallness of the parts are all points, which should be appreciated before the operation can be thoroughly and rapidly performed. The operation, which I have always performed, differs in no way from that performed on the adult. The inguinal canal in the infant is very short, but it still exists, and to expose it in its entire length, the external oblique must of necessity be divided for a variable distance. The sac is generally readily exposed by stretching out the tissues of the cord, and carefully cutting through the various layers and cremaster muscle. The latter and the various coverings of the cord are comparatively well developed in the infant, and are, at times, very confusing. The only certainty that the sac is exposed is after opening it to pass a blunt instrument into the peritoneal cavity. The type of sac should then be demonstrated. If it is a partial funicular sac, it is isolated thoroughly from its coverings, and from the spermatic cord, and, in this connection, must be borne in mind the delicate nature of the sac, which will tear very rapidly on traction. If it should tear at the level of the internal ring, and the aperture of communication with the peritoneal cavity be not obliterated, a cure cannot be expected. The vas in the infant is very small, and appears on the sac as a fine white cord which may be easily damaged without care. The sac, having been isolated up to the level of the internal ring, is gently drawn upon, freed from any subperitoneal fat, which may appear, torsioned so as to render the peritoneum in the neighbourhood taut, ligatured, and removed. In the infant, the bladder is more or less an abdominal viscus, and it may easily be drawn into the wound when the sac is being drawn down. This has happened to me on several occasions, and I always make a point of thoroughly cleaning the sac on its inner aspect. A warning that the bladder is near is given by a quantity of subperitoneal fat appearing on the inner side of the neck of the sac, whilst thoroughly exposing the latter. If the sac is of the total funicular type, I divide it across at a convenient level, and treat the upper part as described above. The lower portion of the processus vaginalis I pay no attention to, but simply leave it open. Particular care is required to avoid wounding the vas and vessels, which, in by far the majority of cases, lie behind the sac. The method of closure of the inguinal canal varies with the size of the hernia and the condition of the internal oblique. In the majority of cases, with a well-developed internal oblique, a couple of sutures are passed through it and the torn cremaster, sewing these to Poupart's ligament, the sutures lying over the cord. But in large herniæ and in older children, where the internal oblique has been thinned from pressure, a more secure wall, I think, will result from pleating the internal oblique and conjoined tendon to Poupart's ligament behind the cord. The cut margins of the external oblique are united, and if this tendon appears very lax, the union is effected by overlapping this aponeurosis in two layers of sutures. I always employ subcutaneous sutures in order to control any reactionary hæmorrhage, which may occur from the thick cushion of subcutaneous fat which has been divided. These, I think, prevent the formation of hæmatomata into the scrotum, which are very annoying and are often the cause of a troublesome suppuration. I have never had any of the hæmatomata in my cases. All deep sutures are of catgut, with the exception of the ligature on the sac, which is of silk. This is the only ligature used. The skin edges are approximated by a subcuticular suture, the main merit of which, in the infant, is its easy and painless extraction.

The Ages at which Operation was performed are :—Within the first 6 months of life, 26 cases (including 6 cases of strangulation); 10 cases, in which attempted strangulation had occurred on more than one occasion, and the hernia had only been reduced with difficulty; in a few cases, the hernia was of large size, and could not be controlled satisfactorily by a truss; in the remainder, the baby was bottle-fed, and there was no contra-indication to operation). The youngest infant was 5 weeks old, suffering from a strangulated hernia.

Between the ages of 7 and 12 months, there were 34 cases; during the second year, 30 cases; after the second year, 36 cases.

I have not had one fatal case. Suppuration has occurred in 6 cases. One of these cases, which suppurated, was operated upon for strangulation; one was a congenital cæcal hernia, which occupied some time in reduction; one was a case operated upon three days after attempted strangulation and difficult reduction, the tissues being still œdematous: three cases were delayed symptomless suppuration, a little pus being seen at one part of the wound, when the stitch was withdrawn. Apart from these cases of suppuration, I have not noticed any untoward complication.

An attempt has been made to follow the after-result of all cases, but, as so often happens in hospital patients, this has been impossible in every case. In only 75 per cent. has this been possible, and, in every case, the result has been perfect, the most recent case being operated upon three months ago. There has not been a suspicion of a recurrence. Two of the series were called recurrent herniæ. These were in children of 4 and 8 years of age, in whom I could not obtain the notes of the former operation. But these can hardly be called recurrent herniæ, since in each case a total funicular sac was present, which had obviously been untouched at the first operation.

In 21 cases of the series, the hernia was bilateral. In such cases, I have often performed the operation on both sides at the same time. In some cases, however, in young infants I have performed it at different times, thinking that it might be safer in a young infant not to prolong the operation. But, in the majority of cases, the two sides may be operated upon at the same time.

Contents of the Sac.—In the majority of cases at the operation the sac is empty, and the relative frequency of the hernial contents it is impossible to estimate. Small intestine is without doubt the most frequent content. Omentum is not very infrequently seen in older children, but very rarely in the infant. I have only found it necessary to remove omentum on four occasions. In one of these, the omentum was nipped at the internal ring, and thus constituted a strangulated hernia.

HERNIA OF THE CÆCUM AND APPENDIX.

It is impossible to estimate the frequency with which the cæcum and appendix are found in an inguinal hernial sac, since the latter is so often empty at the time of operation. But there is no doubt that it is not at all an infrequent content of a right hernial sac. When the sac forms a complete covering for the cæcum, and the latter slips into it by virtue of its elongated mesentery, the relationship is identical with prolapse of the small intestine. Of more interest are those cæcal herniæ with an incomplete sac. These are variously called "congenital cæcal herniæ," the "sliding" type of hernia, or the hernia *par glissement.* In this variety, the cæcum raises the posterior wall of the sac, the peritoneum is reflected from the sides of the cæcum to the sac wall, leaving, it may be, some of the posterior wall of the cæcum uncovered by serous membrane. This uncovered area of the cæcum is of variable extent. Cæcal herniæ are often of large size, often irreducible in whole or in part, difficult to detain by a truss, and not infrequently become incarcerated or strangulated. In my series, I have had two examples of this variety of hernia. The ages of the children were eight and six months respectively. The hernia in each case was noticed soon after birth. At first the herniæ were said to have been completely reducible, but, when presented for treatment, complete reduction was impossible. The reducible part of the hernia in each case was small intestine, which had also prolapsed. In the posterior wall of the sac was the cæcum. The latter was separated from the tissues behind, and forced upwards. The anterior and lateral portions of the sac were removed, and the aperture into the peritoneal cavity closed with sutures as effectually as possible. The inguinal canal was closed after Bassini's method. Such cases might be expected to relapse more frequently than those herniæ with a complete sac, since there is no neck of the sac to close, and the peritoneum around the internal ring cannot be made taut. In both these cases, the cure remains sound after 12 and 15 months respectively.

With the cæcum, the appendix is also generally present in whole or in part. But the appendix alone may be seen. When the appendix presents during the operation, whether diseased or not, it may be removed. I have removed the healthy appendix in four cases, in which it was seen during the performance of the operation.

Of considerable interest are those cases, in which the appendix is found diseased in a hernial sac. The appendix may be tuberculous, but more frequently it is inflamed similar to when situated in the abdomen. Strangulation of the appendix may also occur.

Of appendicitis in a hernial sac, I have had three examples.

Case I.—Male child, aged 3 years and 8 months, not noticed to have had a hernia. The illness commenced with abdominal pain. Some hours later the child complained of pain in the groin. The right side of the scrotum became swollen, as also the right groin. The temperature was 102°. On the third day of the illness, an abscess was evidently present and was incised. A hernial sac was unsuspectingly opened, and the terminal portion of a diseased appendix was seen in it. The abscess was drained and healed in about three weeks.

Case II.—A boy, aged 8 years, when an infant had suffered from a right inguinal hernia, had worn a truss for some months, and was thought to have been cured. His illness began with some abdominal discomfort: on the following day he complained of pain in the scrotum, and the temperature was 100° F. In two days' time these symptoms disappeared. After this he frequently had some pain in the scrotum. A second attack of abdominal scrotal pain occurred a little later.

The right side of the scrotum was thickened by a cord-like structure running from the testicle up the inguinal canal. The appendix was diagnosed. This was verified by operation and removed. It was intimately adherent to the tunica vaginalis, but nowhere else: its distant portion showed chronic inflammatory changes.

Case III.—A boy, aged 8 years, who had had a hernia since birth. For this he had at one time worn a truss, and was considered cured. One day a painful swelling formed in the right inguinal region, and the boy was said to have been feverish and sick. This was thought to have been the return of the hernia. The symptoms disappeared in a day or two, but the swelling did not entirely disappear. At the operation, a swollen appendix, adherent to the tunica vaginalis and slightly to the sac wall, was found, and removed.

There are one or two conditions with which appendicitis in a hernial sac may be confounded. Most frequently the cases are mistaken for strangulated hernia. There are many points of resemblance, viz. :—the sudden onset, the abdominal pain, the sudden appearance of a swelling in the inguinal region and scrotum, irreducible or without impulse, or, should the hernia have been down previously, its sudden increase in size. There are, however, some points of difference. In appendicitis, some fever is present from the beginning: the temperature is generally sub-normal in strangulation. The swelling in an obstructed hernia is rounded, well-defined, tense, and elastic : in appendicitis, it is ill-defined, and the skin early shows some signs of inflammation. In both conditions, constipation may be present, but is more absolute in the obstructed hernia. In short, in the one case, there is a primary obstructive lesion with inflammatory signs long delayed, and, in the others, a primary inflammatory lesion as shown by fever, œdema, and ill-definition of the swelling.

Inflammatory conditions of the testicle can generally be differentiated by recognising that it is the testicle which is swollen, and the inguinal canal is more or less free.

Torsion of the spermatic cord may be mistaken for acute appendicitis, especially so when, as is not infrequently the case, the testicle lies high, and is imperfectly descended. Here the testicle itself is swollen, the upper limit of the swelling may be reached, and the inguinal canal is free (unless associated with a hernia).

A fourth case, which I had, was that of a boy, aged 6 years, who had worn a truss for some time for a right inguinal hernia. The only content of the sac, at operation, was the appendix. This was adherent to the tunica vaginalis, and was thickened by inflammation. The truss may have been responsible for these changes. There had never been any symptoms of appendicitis. The meso-appendix was considerably thickened.

In a fifth case, I removed a large, swollen, catarrhal appendix from a baby of 11 months. This was free from all adhesions, and prolapsed from the peritoneal cavity during the operation. So far as was known, there had not been any abdominal symptoms in this case.

The pelvic colon is very rarely seen in hernial sacs in children. It is recorded, however, and has been strangulated. In my series there was not one example.

HERNIA OF THE BLADDER.

There was only one example of this complication. On six other occasions, whilst operating upon these herniæ, I have seen the bladder, but these are not true examples of a herniated bladder. In isolating the neck of the sac, and dragging upon the peritoneum, the bladder has been drawn into the wound. All these cases have been in young infants, in whom such a thing might be supposed as very likely to happen. During this manipulation, I have noticed that a mass of extraperitoneal fat precedes the bladder, and I always take the appearance of this as a warning that a little more traction will expose the bladder.

There are three different types of hernia of the bladder:—(1) Without sac, a rare variety, in which the anterior or lateral surface, uncovered by peritoneum, enters the inguinal canal; (2) with incomplete sac, in which the bladder raises the sac wall, and is only covered on one aspect with peritoneum; (3) with a complete sac, a very rare form, in which the protruded portion of the bladder is completely surrounded by peritoneum. My single example falls under class (2).

Case.—Male child, aged 1 year and 1 month; a right inguinal hernia had been noticed shortly after birth: it appeared completely reducible. After opening the inguinal canal, it was noticed that there was a quantity of fat around the cord. The sac was not easily found. This excess of fat around the cord led me to suspect that the bladder was probably quite close, and considerable care was taken not to cut anything of uncertain nature. The sac was eventually found, and, on separating off the fat from it, the bladder wall was exposed. The sac was separated, the bladder pushed back, the peritoneum separated from it as far as possible, a portion of the sac cut away, and the hole in the peritoneal cavity sewn up. The inguinal canal was closed according to Bassini's method. There were no urinary symptoms in this case.

In those cases, in which the bladder has been drawn into the wound during the operation, I have separated the peritoneum as far as possible, and then placed a ligature around the sac close to the bladder, and closed the inguinal canal after the method of Bassini.

HYDROCELE IN RELATION TO HERNIA.

The distinction between a hydrocele of the tunica vaginalis and a hernia is generally an easy matter. It must be remembered, however, that a hernia, in a young infant, is translucent, a fact which is often not clearly appreciated. Should the cavity of the tunica vaginalis be unusually large, and extend up the scrotum even to the inguinal canal, then it probably more often communicates with the peritoneal cavity than is usually supposed. I have noted two examples of this. In one case a child, of 2 years and 11 months, had had a swelling in the right scrotum for 18 months. This was said to vary in size, but never disappeared completely. On examination, it appeared to be a hydrocele of the tunica vaginalis, which was of large size, and extended up the inguinal canal. This could not be reduced. In the second case, the child was two years old, and was said to have had a swelling in the right side of the scrotum since infancy; this had never disappeared. The signs were those of a hydrocele of a capacious tunica vaginalis. In both cases, a tiny communication with the peritoneal cavity was discovered after opening the sac and stretching it out. In one other case, I found a hydrocele of a partial funicular sac which was irreducible before operation, but at the operation was found to communicate with the peritoneal cavity. In a further case, there was present a hydrocele of the tunica vaginalis, and behind this was a partial funicular hernial sac. This was a boy, of 3 years of age, who had a swelling in the right side of the scrotum since infancy. This was regarded as a hydrocele, and was tapped before admission to the hospital. After tapping a swelling again appeared. This second swelling had the character of a hernia. A hydrocele of the tunica vaginalis had been tapped, and behind this was a partial funicular hernial sac.

When confronted with a hydrocele in a child, the possibility of its being a true hernial sac, or of there being a hernial sac present also, should always be borne in mind. Tapping such cases might be dangerous. Even if not dangerous, such a method is not curative.

INGUINAL HERNIA IN THE FEMALE CHILD.

There were 11 examples of this. According to history, these generally were not noticed so early in life as in the male children. In 8 cases, the sac was empty at the time of operation, but in 3 cases, the ovary and Fallopian tube were present as contents. Two of these three cases were children of 2 and 4½ years of age. In each case, the swelling was asserted to have been noticed only a short time before operation ; in both cases the hernia was irreducible. The sac was continuous with the peritoneum of the broad ligament, *i.e.*, the meso-salpinx was attached to the posterior wall of the sac. The contents could not be reduced until this portion of the meso-salpinx was divided close to the tube, and then tube and ovary were pushed just inside the internal abdominal ring. In one case, the ovary was round, and somewhat congested, as was also the prolapsed portion of the tube, seeming as if the internal ring had caused some interference with the blood supply. In the other case the ovary was soft and elongated. The third case was that of a child of three years of age, in whom the hernia had been noticed for six months. The sac was found to be empty at the operation, but the slightest traction on the peritoneum caused the ovary and tube to descend, and it was seen that the peritoneum, in the region of the internal ring, passed directly to the tube and ovary. The sac was separated, and tied without torsion immediately below the ovary.

All three cases were left-sided herniæ. In neither case was it possible to detect any abnormality in the development of the uterus. In all cases, the ovary would become anchored just inside the internal ring.

Whenever possible, a herniated ovary should be replaced. The size, shape and consistency of ovaries in children differ markedly. It does not seem justifiable to remove the ovary, unless obviously damaged, or diseased by such complications as strangulation or pedicle torsion, or unless it is irreducible, as it may be when situated low down in the sac.

TUBERCULOSIS OF THE SAC.

I have had two examples of this.

Case I.—A boy, aged 3 years, had been known to have a right inguinal hernia for twelve months. A truss had been worn, but this was ineffectual in controlling the descent of the hernia. During the operation, the sac was noticed to be very thickened ; it was opened, and on its interior were a number of miliary tubercles (confirmed by microscopical examination). The sac was a partial one ; it was removed, and the canal was closed. Before closing the sac, a portion of intestine was drawn down, and this was studded with miliary tubercles. There was no escape of fluid from the peritoneal cavity. On examination of the abdomen, whilst under anæsthesia, some indefinite thickening was felt in the lower abdominal region. The child had never had any symptoms of tuberculous peritonitis. At the present time, ten months later, the child is in excellent health.

Case II.—A boy, aged 2 years and 8 months, had had a hernia since infancy. A truss had been worn, but was ineffectual. On opening the sac, some fluid escaped from the peritoneal cavity, and, on examining the interior of the sac, numerous miliary tubercles were scattered over it (confirmed by microscopical examination), and were also seen upon a coil of small intestine which herniated during the operation. The sac, which was a partial one, was removed, after compressing as much fluid as possible out of the abdomen, and the canal was closed. On examination of the abdomen at the close of the operation, nothing abnormal was felt. The ascites was overlooked before the operation. The child made a speedy recovery, and, sixteen months later, was in sound health. There had not been any abdominal symptoms previous to operation.

Tuberculosis of the hernial sac is found more frequently in the child than in the adult. Hernia being more frequent in the child, and tuberculous peritonitis being more often unattended with symptoms in the child, might account for this. Many instances are recorded of this condition, and operation has been often performed without suspecting the real state of affairs. In many cases, abdominal tuberculosis has been present. In some cases, the testicles have been tuberculous; in others the ovary and tube have been diseased; in other cases, again, the case is recorded as an isolated tuberculosis of the hernial sac. Most frequently in the child this condition is merely a part of a general abdominal tuberculosis. The same variety of lesions has been described in the hernial sac as in the peritoneum, the ascitic, the dry, and the caseating types.

The diagnosis of this condition is not often, nor is it easily, made. A sac, containing fluid, and particularly if there is such a sac on both sides, should always be regarded in the child with suspicion, and lead to a careful examination of the abdomen. A sudden and painful enlargement of a hernial sac, irreducible, or only in part reducible, without signs of strangulation, should excite suspicion of the ascitic form. If there is evidence of abdominal tuberculosis, then the diagnosis may be easy, but, in these cases, the abdominal signs are often absent, and the true condition is then unsuspected.

STRANGULATION.

Attempted strangulation, *i.e.*, when the hernia suddenly descends evidently with pain, and becomes very tense, is a very common complication of these herniæ. This generally occurs in young infants within the first year, or often within the first six months of life. Reduction should at once be attempted. If this is not easily effected, it is probably useless to continue further force against the tightly-contracted abdominal muscles. Chloroform should be given to relax the muscles, and then very frequently reduction may be accomplished. Sometimes the hernia will disappear as the child is going under the anæsthetic, sometimes it happens that the hernia suddenly reduces itself beforehand, in spite of the fact that taxis has failed, and it has happened to me that the child has been anæsthetised and taxis has failed, and then, when being anæsthetised for an operation, spontaneous reduction has occurred. It is very curious how some of these excessively tense hernias will sometimes reduce themselves, even after taxis has failed.

Nine of my cases, I operated upon for irreducibility. In one case, immediately on incising the external oblique, the tense hernia suddenly slipped back before the sac was opened. In two other cases, after incising the external oblique and opening the sac, the hernia was readily reduced on slight pressure. The strangulating agent, in these three cases, may have been the margins of the external abdominal ring. In the remaining cases, reduction was not so simply accomplished, and, even after incising the external oblique, the hernia remained quite as tense as before.

In four cases (one containing the appendix only, and one omentum only, and two small intestine), reduction was not effected until the neck of the sac had been well exposed, the internal oblique fully retracted, the sac opened, stretched, and firm pressure applied to the gut. The constriction on the intestine in these cases was produced by the tissues at the level of the internal abdominal ring. In one case, an infant of five weeks old, the contents of the hernia were the cæcum and appendix. The cæcum was much distended, and had to be punctured to allow of the escape of gas, before it could be returned ; the appendix was removed. In only one case, had I to divide the neck of the sac from within. This was an infant, in whom, as the result of taxis, a hæmatoma had formed in the mesentery. After reduction, it was possible to secure the cut edges of peritoneum, and effect a radical cure.

In these cases, the site of strangulation was more frequently found at the internal than at the external abdominal ring. The general constitutional symptoms were not as severe as might be expected from the local signs. Collapse was not very marked compared with the collapse attending an internal strangulation. Vomiting was generally absent. In no case was the bowel damaged. Superficial suppuration occurred in one case, which did not, however, affect the final result.

SOME RECENT CONTRIBUTIONS TO THE STUDY OF ANÆSTHETICS.

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A PAPER on "The Action of Anæsthetics on Lower Organisms," which Professor F. W. Keeble read before the Society of Anæsthetists, contains a number of facts which are both interesting and highly suggestive to those employed in either the investigation or the use of anæsthetic agents. Since the time of Claude Bernard it has, of course, been known that plant-protoplasm, like animal-protoplasm, possesses the property of irritability. It is only comparatively recently, however, that anæsthetics have been employed in relation with this irritability to help in the elucidation of problems of metabolic activity. The mechanism of irritability may differ in the higher members of the vegetable and animal kingdoms, but the essential quality, the power of reaction in an ordered, purposeful way, is enjoyed by all. Thus anæsthetics have been made the means of exploring plant-sensitiveness. They have shown, for instance, that the impulse resulting from appropriate stimulation is not, in the case of the sensitive plant, of a nervous, but of a purely mechanical nature. The impulse may travel along a leaf-stalk which has been anæsthetised with chloroform. This, however, Professor Keeble appears to regard as an exceptional case, in which, though perception of and reaction to stimulus are dependent upon vital apparatus, yet the transmission is effected by a system of tubes, which remain efficient, though anæsthetised. In some cases, when a plant is subjected to a limited amount of chloroform, perception is uninfluenced, though reaction is inhibited, whereas, in other cases, perception is destroyed, although the machinery for reaction remains intact. By graduating the dose of chloroform, the perception time may be increased from the normal, 20 seconds in bean-roots, to several hours. A detailed study of the morphological effects of anæsthetics on protoplasm has yet to be made, our present knowledge consisting only of a number of isolated observations. It may be remembered that, not long ago, changes in certain cells of the cortex cerebri were described as depending upon the action of ethyl chloride, and various similar observations, not always convincing in their nature, have from time to time been reported. In the case of lower organisms, such investigations of this kind as there are seem to be more trustworthy. Thus chloroform produces a contraction of the pseudopodia of Foraminifera, a contraction which may be even half the original length, and is accompanied by beading of the protoplasm. A similar contraction is produced in the pseudopodia of leucocytes. In Stentor, chloroform water gives rise to first a marked contraction, and then a mid-condition or partial expansion, which is maintained even on stimulation. That is to say, contractibility is lost. Ciliary action is affected in the same way; it is first excited, and afterwards inhibited.

That this preliminary excitation is a universal effect of anæsthetics is made probable by observations of their action on protoplasmic streaming in vegetable cells. Very small doses of ether produce a slight acceleration of the streaming movements and when the amount of ether is increased the movements are at once retarded and soon cease. On removal of the object to pure water the streaming is resumed, if the infusion in the anæsthetic was not too long, and again an acceleration of the original rate is to be observed. Similar reactions have been recorded by Engelmann and others, in the case of cilia in the buccal cavity of the frog, in Infusoria, and in Spermatozoa. No hypothesis of the mode of action of anæsthetics, so far as I am aware, throws any light on this initial exciting effect of ether or of chloroform, an effect which Waller has so well demonstrated in his well-known muscle-nerve experiments. A striking illustration of the general fact, that anæsthetics act more rapidly on specialised nervous tissues than on less specialised tissues, is afforded by the behaviour of certain crustaceans when placed in water containing ether. The animal in question (Hippolyte varians) has a richly developed system of chromatophores in its superficial tissues. The pigments contained in these chromatophores are red, yellow, and blue. By expanding or contracting these pigments, the colour of the animal is brought into harmony with that of its surroundings. At night, the blue pigment alone is expanded, and thus the animals take on an exquisite nocturnal blue colour. When one of these creatures is placed in water containing ether, the diurnal colour rapidly gives way to the nocturnal blue. The explanation suggested is that the diurnal colour is maintained by tonic impulses from the central nervous system, and that the ether inhibits these impulses; as chloroform or ether may abolish "tone" in muscles of higher animals, so they may abolish it in the chromatophore system of the crustacea. The similarity between phenomena of anæsthesia, as we are familiar with them in the higher animals, and those exhibited by lower organic bodies, is shown again by the greater readiness with which the effects of ether are removed from them than are those of chloroform. A curious fact also mentioned by Professor Keeble, in the paper to which I have alluded, is the positive chemiotactic action of ether upon some bacteria. In the presence of ether, certain bacteria move towards it, and, in this way, meet their death. Again, karyokinesis is a phenomenon, the nature of which is interfered with by anæsthetics, ether causing an amitotic division in place of one that is karyokinetic. A word may be here given to the etherisation of plants, a process which from its marketable value has been much discussed. Johanssen showed that, by exposing certain kinds of plants, at certain stages of their development, to the vapour of ether, the period which they require for the opening of their flowers is considerably abbreviated. An explanation offered is that the ether inhibits those chemical changes, going on in the resting phase, which are internal stimuli effecting a slowing down of respiration and of growth; the slowing processes being inhibited by the ether, flowering occurs prematurely. The condition known as "delayed chloroform poisoning," or sometimes as "acid intoxication," has recently given rise to a considerable amount of more or less controversial literature. The cases alluded to under these terms afford indeed much scope for difference of opinion, and it is probable that, at the present time, when the idea of delayed chloroform poisoning is first being seriously received, cases are classed under this head, in which the symptoms and fatal result will prove, with increased knowledge, either independent of the anæsthetic altogether, or, at any rate, to be in a different category from other cases with which they are now grouped. Dr. Leonard Guthrie, who has done most in Great Britain to draw attention to these cases, described a series of instances in children in the *Lancet* so long ago as 1894. His paper was entitled "Some Fatal After-effects of Chloroform in Children," but it did not at the time, make many converts, and it was commonly held that such cases, as Dr. Guthrie described, were very likely due to undetected sepsis or to carbolic acid poisoning. In later cases, these two factors have been positively excluded, and it is now generally admitted that there are occasionally, after the inhalation of anæsthetics, and particularly of chloroform, deaths of the kind described by Dr. Guthrie. The characteristic features of such a case are briefly these :—The patient is usually a child ; the operation has not been a long or severe one, and nothing unusual is noticed during anæsthesia, which is recovered from in the usual way. Within forty-eight hours, however, vomiting begins, and becomes persistent, the vomited matter often resembling beef-tea dregs (altered blood pigments probably) ; restlessness, screaming, and delirium, alternating with apathy, follow, and there is usually some pyrexia before death, which occurs on or about the fifth day. Acetone is present in the urine, and the odour of it in the breath. Post-mortem marked fatty changes are found in the liver, and also in the kidneys and in the heart. So long ago as 1850, Casper (*Wochenschrift*) stated his belief that chloroform might leave behind it a state of "chronic poisoning," which might end fatally, hours, days, or even weeks, after the inhalation. It is only, however, since Dr. Guthrie's papers that cases of this kind have been recorded, and of late instances have been abundantly related. Two, by Dr. Crawford Renton, appear in the *British Medical Journal* so recently as March 16 last, and others by Mr. Robert Campbell in the *Medical Press* of February 20. Numerous instances are on record from the Continent. The elucidation of the nature of these cases is complicated by the mystery that pertains to sickness after anæsthetics in general. It has been contended that many cases of sickness after chloroform, which do not end fatally, are really nothing but mild instances of the same defect which is fatal in the cases alluded to above. At present, we are in almost complete ignorance of the sequence of events in the causation of post-anæsthetic vomiting. Certain clinical facts we have, such as the efficacy of careful preparation beforehand, and of care in the selection, and skill in the administration of the anæsthetic, and of perfect immobility of the patient during recovery, yet, with every proper precaution being taken, it is a fact familiar to all anæsthetists of experience, that certain individuals will suffer from sickness after, whilst others will be quite immune from any such trouble. It is often possible to prophesy beforehand what kind of a recovery the patient will make, but, at present, not knowing the essential difference between the types of individuals, we are at a loss how to give to the patient who is intensely sick, the comfort which is enjoyed, for instance, by the chronic alcoholic who recovers from a long anæsthesia without a moment of uneasiness. A step in the explanation of after-sickness will be taken when the simple fact has been ascertained whether it is, as has been maintained, or is not always associated with the presence of acetone in the urine. A series of observations upon unselected cases, before and after anæsthetics of various kinds, is now being made at St. George's Hospital with this object in view. Dr. Guthrie's explanation of the cases of "delayed chloroform poisoning" which he and others describe, is that there is a pre-existing fatty condition of the liver, that this is disposed to fatty metamorphosis by chloroform, and that the excessive accumulation of fat gives rise to acid intoxication, which is responsible for the clinical symptoms.

He is led to postulate the preliminary fatty liver by the apparent impossibility of such pronounced changes being produced in so little time, and by so small an amount of the drug as comes into play in many of the cases. In discussing this theory, Dr. H. D. Rolleston has suggested that the acid intoxication is produced by the action of chloroform on the fats of the body generally, and that the fatty change in the liver follows; in other words, that acidosis produces fatty liver, and not vice versâ. The action of the poisons present in acidosis, and of chloroform, so impairs the vitality of the liver cells that, pathologically, fatty infiltration is enabled to recur. In favour of the view that fatty liver is not the cause of the intoxication, he cited the most commonly known instance of acid intoxication, viz., diabetic coma. In this case, the liver is not usually excessively fatty. In diabetes, starvation, due to inability to utilise the sugar in the blood, leads to excessive destruction of the fats of the body, and so to acidosis. The question, therefore, arises as to what part starvation plays in these post-anæsthetic cases. Starvation is usually a factor present in some degree, owing to the preparation of the patient for operation, at times it may be of considerable duration, and much enhanced by vomiting, and further abstinence from food after anæsthesia.

Beesley (*Brit. Med. Jour.*, May 19, 1906) maintains that a certain degree of acid intoxication takes place after every surgical operation, for which a general anæsthetic is given. He draws the deduction that symptoms of intoxication occur only when the kidneys are failing to excrete the acetone, that when death takes place it is due to inability on the part of the kidneys to cope with the demands made upon them.

Other observers have held that it is not acetone itself, but poisonous precursors of this substance, which are the element of danger. According to Beesley, the symptoms of acid intoxication may be mitigated by the administration of alkalis, and it may here be noted that for years it has been a common practice to give sodium bicarbonate in large doses to quell post-anæsthetic vomiting. It is also recommended that alkalis should be given beforehand in liberal amounts. It may be mentioned that the contention has also been put forward that these cases only occur when chloroform is given in a too highly concentrated vapour. It is certainly regrettable that, in most of the cases hitherto related, details as to the quantity of the drug used, and as to the method of its administration, are but meagre. At the same time, such an objection as that first mentioned, leaves untouched any explanation of the cases described, in which ether, and not chloroform at all, has been the anæsthetic employed. Other writers have found reason to question the purity of the chloroform used in cases which have been followed by "delayed poisoning."

Mr. Robert Campbell quotes Dr. Rankin in an interesting observation to the effect, that, while it is well known that herbivorous animals are bad subjects for chloroform, the children of the poor, at about the age of four years, that is to say, the class of child who provides the majority of instances of acid intoxication, are also, practically speaking, herbivorous. The similarity between the symptoms exhibited in cases of periodic vomiting of children, with those of delayed chloroform poisoning, is also worthy of mention.

The Passage of Anæsthetics from Mother to Fœtus, and to suckling, formed the subject of a recent discussion at the Obstetric Society of Paris. In practice, hitherto, the possibility of serious amounts of anæsthetic reaching the suckling in the mother's milk, and producing undesired effects upon the infant has not been considered to be of moment. As soon as eight hours after operation, a mother, who had been under chloroform for 25 minutes, has fed her child from the breast with no apparent ill-effects to either. The matter is not of much practical importance, since a substitute for the mother can, of course, always be provided by artificial feeding during the short period that she may be presumed to be harmful by reason of the presence of chloroform in her milk. M. Niclaux has found that this anæsthetic may be present in a higher proportion in the milk of goats than in the blood itself, a fact that is not surprising, when we remember the strong affinity that chloroform has for fats. Indeed, the whole process of anæsthetisation depends, according to some observers, on this affinity between chloroform and the organic fats of protoplasm, by reason of which the drug is assimilable into the tissues of cells. Similarly, M. Niclaux found that not only does chloroform travel freely from mother to fœtus (in guinea-pigs), but that the liver of the latter holds more than that of the former, and this phenomenon is attributed to the superior amount of lecithin in the younger liver. The possibility of harm, resulting from the passage of chloroform to the fœtus, seems a more serious consideration than in the case of the suckling. During a difficult confinement, a mother may inhale large amounts of chloroform, and it is readily conceivable that the infant might be poisoned. Yet, beyond some drowsiness in infants delivered after long administrations of chloroform to the mother, no material effect appears to have been noted. A case has been related by Mr. Schwab, in which, the mother having undergone an obstetrical operation under ether, the infant at birth required artificial respiration, and its respirations were strongly impregnated with the smell of ether. The general opinion appears to be that although chloroform given to the mother rapidly reaches and affects the fœtus, yet it is also rapidly eliminated and gives rise to no danger. There must, however, be the chance of its acting on the fœtal central nervous system, since it reaches the infant's circulation, and therefore, after a long internal administration, special care should be taken to ensure active respiration on the part of the infant after birth.

The Physiology of Anæsthetics has been the subject of much recent experimental work. The special Chloroform

Committee of the British Medical Association has been the cause of several investigations, which have given greater accuracy to knowledge relating to the passage of anæsthetics through the subject.' The effects of known doses of chloroform upon cardiac, and upon skeletal muscle, have been investigated, and attempts have been made to determine, with accuracy, the percentage of chloroform which induces anæsthesia when inhaled into the lungs, how much of this is retained in the blood, and how much escapes with the respirations. In a paper, recently read before the Royal Society, Buckmaster and Gardner also deal with the question of the percentage of chloroform present in the blood of anæsthetised animals. They find for cats a quantity between 14 and 27·6 mgr. per 100 grms. of blood at the time of disappearance of the conjunctival reflex. The amount varies with individual peculiarities of animals, but is not affected, according to these observers, by the body-weight of the individual. The lethal dose is also variable, and is found to be about 40 mgr. per 100 grs. of blood. All recent experimental work bears out, what is familiar to clinical anæsthetists, the narrowness of the margin between the dose necessary for anæsthetisation and that which produces a fatal result. Buckmaster and Gardner dealt particularly with the fate of inspired chloroform after it reaches the blood. They find that by far the greater part of the absorbed chloroform is held by the corpuscles, the plasma getting very little, unless anæsthesia is very rapidly induced, or is pushed to an extreme degree.

The contention of Desgrez and Niclaux that chloroform is decomposed in the organism, and that carbon-monoxide is present in the blood after prolonged chloroform inhalation, is not borne out by the English experimenters. Professor Brodie's report to the committee mentioned above deals with a point that is of the highest practical importance. He has estimated the rate of absorption during the induction of anæsthesia by chloroform, and shows a scientific explanation for the long-accepted clinical fact that the early stages of chloroform anæsthesia are those most easily associated with danger. The rate of absorption of the drug is higher during the second minute of its inhalation than at any other period. At the same time, the volume of chloroform in the expired air is, during this time, proportionally less than at any other moment of the inhalation. The rate of absorption is found, as it was also by Tissot, to correspond roughly with the degree of lung ventilation. Tissot holds that the danger of the early stage of inhalation depends upon the influence of lung ventilation "during the forced rapid breathing, and that which is apt to occur in a stage of excitement, a dosage becomes dangerous which, with normal respiration, barely suffices to secure anæsthesia." According to some experiments of Professor Vernon Harcourt, the amount of chloroform retained is about one-third of that administered.

A few words concerning the physiology of *ethyl chloride,* in connection with which drug fatalities have been numerous in accordance with its wide popularity and too careless employment, may be here introduced. Experimental work with this anæsthetic does not seem to have been abundant, but such as it is it should serve to put us on our guard, as having here to do with an agent of great power, as regards its ability to diminish, and abolish, the force of the two great vital functions of circulation and of respiration. The earlier observations tended to the conclusion that ethyl chloride, when inhaled in toxic quantity, became fatal by causing convulsion and respiratory spasm. Later experiments, however, show that this drug acts directly also upon the circulation, and that it weakens the action of the heart, probably acting directly upon the musculature of that organ. The heart-stopping effects were produced, whether the vagus nerves were cut or were intact. This direct paralysing action upon the heart is, in all likelihood, the cause of the fall in blood pressure, which several observers have noted, when full doses of ethyl chloride are employed. Thus Wood and Cerna state that they found a regular and rapid lowering of the blood pressure ending in arrest of respiration and circulation. They attribute the circulatory depression to "the effect of the drug upon the heart." Other observers believe that ethyl chloride affects the heart also through the vagus centre. They compare its direct action upon the heart with that of chloroform, and find that it first stimulates, and later paralyses, the respiration and circulation. The experimental work that has been done, therefore, on ethyl chloride, would help us, if corroborated clinically, in marking out certain classes of subject as obviously unfitted for anæsthesia by means of this agent.

C.E.—ETHYL CHLORIDE—CHLOROFORM SEQUENCE.[1]

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The following remarks are a brief record of some inductions of chloroform, and C.E. anæsthesia brought about with the assistance of ethyl chloride. I have been using ethyl chloride in this connection for the past two or three years. The sequence, which I have finally adopted, I call the C.E. ethyl chloride, chloroform, or C.E., ethyl chloride, C.E., sequence, as the case may be, and this paper is based on the notes of 200 consecutive cases of these sequences.

I am not claiming any great amount of originality for this idea of using ethyl chloride in the induction of chloroform anæsthesia. I have no doubt that all of us have adopted it, in some manner or another, at different times ; altogether, I suppose I have used ethyl chloride in this connection some 400 times, and it was only after trying various methods that I appreciated the advantages of the one which I am about to describe, and set to work to secure notes on a series of consecutive cases. I wish to lay some stress on the circumstance that these cases are consecutive, and not selected. Had I selected my cases of this sequence, I believe that I could have produced a series of nearly flawless inductions. All cases, in which a chloroform or C.E. anæsthesia appeared desirable, were submitted to this induction, unless ethyl chloride was for some reason distinctly contra-indicated, and I may say that this occurs very rarely in my practice.

In the early days of ethyl chloride, I tried, in a few cases, a simple ethyl chloride-chloroform sequence, giving ethyl chloride in the usual manner, and then going on with chloroform. This however, I soon abandoned, and now only use, in a few cases, like short operations on the nose or throat, where I sometimes help out my ethyl chloride, as it were, by going on with the Junker apparatus, no real chloroform anæsthesia being developed in most cases. In order to explain my reasons for abandoning this particular method, I must first point out what advantages I hoped to gain by using ethyl chloride.

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[1] Paper read at the Society of Anæsthetists.

My principal reasons for adopting any innovation in the induction of anæsthesia are the following, given not in order of importance, but in the order in which I rather looked for improvement on my usual method :—increased comfort for the patient, saving of time, and increased safety and precision.

Now the majority of chloroform patients, in general surgery, are women and children, and for them the anæsthetic has very real terrors, which the clapping on of a closely fitting mask and the sudden exhibition of a concentrated vapour only intensify. Time is saved no doubt in most cases, but not always, owing, in my hands at any rate, to some lack of precision in this method.

As to safety, I think that this is rather decreased than increased by presenting chloroform vapour to a patient with exaggerated breathing, and lungs full of ethyl chloride vapour and re-breathed air, also that there are many pitfalls for the unwary in the symptoms produced by the passage from the ethyl chloride to the chloroform anæsthesia.

For these reasons, then, I gave up the simple ethyl chloride, chloroform sequence, and am of opinion that it is an unsafe procedure, unless the chloroform is inhaled from a Junker's apparatus, or from some form of regulating inhaler.

Having observed in the ethyl chloride, ether sequence, the advantages of an early gradual exhibition of the ether, thereby getting the patients under the combined vapours, instead of first anæsthetising them with ethyl chloride alone, I determined, so far as possible, to apply a similar method to chloroform inductions.

And this is the way I have set about it in the series of cases to which I am drawing attention.

The only apparatus I use is a chloroform mask and a folded towel. One word I may say about the mask, hardly necessary, perhaps, to anæsthetists; the mask should be of such dimensions that there is no risk of its coming into contact with the patient's nose during the second stage of this procedure, when the towel may be pressed closely around it. There is not much danger of any other part of the face becoming scorched, as the amount of C.E. used is too small to run down the sides, but this risk can be obviated by using one of the modifications of Schimmelbush's mask, if thought desirable. I frequently, but not invariably, insert a prop before commencing. In strong muscular men, in whom there is likely to be much jaw spasm, and in all operations on the upper air passages, I think it advisable.

The sequence, as its name indicates, consists of three stages, and anæsthesia should be, and generally is, present at the end of the second.

In the first stage, the patient inhales C.E. mixture from the mask, the quantity varying from one to three drams, according to age and physique. After a little time, varying from half a minute to one and a half minutes, I spray on ethyl chloride from 3 to 7 c.c., and apply the towel closely over all. This is the second stage. It ends with the loss of the corneal reflex, generally lasting from a quarter to one and a half or two minutes. The towel is now removed, and the third stage entered upon. It simply consists in maintaining a proper degree of anæsthesia by means of the C.E. mixture or chloroform. A little judgment and practice soon enable one to steer the middle course, and, without overdosing, to give patients sufficient to prevent any return of consciousness.

I will now briefly discuss the symptoms evoked.

Struggling in children and timid people may come on at the first application of the mask. This is, of course, simply due to terror, and, if there appears any chance of calming the patient, I always try to do so at the risk of prolonging the first stage. However, as a rule, it is very little use trying to reason with children of this type, and the quickest and kindest way is, I am sure, to proceed rapidly to the second stage. There is very occasionally, in young people, a little struggling due to the anæsthetic, towards the end of the first stage. With the second stage, struggling is sometimes marked, more especially in big strong men and alcoholics. In many cases, however, there is practically no struggling or movement at all, and, anyway, though very severe sometimes, it is, I am sure, of much shorter duration in this method of induction than in the ordinary one. A frequent event, with muscular individuals, at the commencement of the second stage, is a stiffening of the trunk and limbs, with a tendency to raise the head and shoulders from the couch ; this is often accompanied by holding of the breath, and usually subsides in from 30 to 60 seconds, the patient becoming more or less relaxed.

The Respirations.—There is nothing special to be noted about the respiration during the first stage ; sometimes, as stated above, it is held for a few seconds at the commencement of the second stage, but the ethyl chloride soon produces its usual effect, respirations being increased in depth and rapidity, and, with this, one generally gets the characteristic flushing of the face. On removing the towel, the tendency is, of course, for the respirations to become less exaggerated, but, with a little care, they never drop to normal, but gradually pass into the type associated with chloroform or C.E. anæsthesia. Should they become shallow during the third stage, it means that either too much anæsthetic is being given, or too little ; by watching the symptoms to be considered next, I find it, as a rule, quite easy to decide.

The Corneal Reflex.—This is present during the first stage. During the second stage, there is occasionally so much spasm of the orbicular muscles as to make it difficult to know precisely when it is lost, but, as a rule, there is no difficulty, and its disappearance is the signal for the removal of the towel. In a few cases, it does not disappear readily, and I then, after allowing two minutes for the second stage, pass on to chloroform. These cases generally take a little longer than the average over the induction, and are always found to be people who require a large amount of anæsthetic to keep them under. The corneal reflex frequently returns during the third stage, and here, taken in conjunction with the condition of respiration and the next symptom, is a guide to the depth of anæsthesia.

Jaw Spasm.—This symptom is one to which I attach great importance in the induction of anæsthesia by this sequence.

It comes on during the second stage, and I always test it immediately at the close of this ; it may be slight, the jaws being closed but not firmly ; as a rule, the teeth are firmly clenched, and the jaws only separated with the employment of a considerable degree of force. In some cases, it is marked, and the jaws cannot be separated except by the employment of a wedge or gag. In a few cases it is absent. By watching the jaw during the third stage, one has a valuable guide to the depth of anæsthesia, the spasm gradually passes off under the influence of chloroform. So long as it remains, no matter what other symptoms are present, one may feel sure that the patient is not getting too much chloroform. On more than one occasion, in giving this sequence, I have been confronted during the third stage with the following condition.

The breathing has become shallow, the flush has passed off the face leaving it pale, the corneal reflex could not be evoked.

Chloroform had been exhibited pretty freely, owing possibly to marked struggles, a prolonged second stage, or marked jaw spasm at the end of it. All this tended to make one think of the possibility that sufficient chloroform had been given. But a persistent jaw spasm has been the key to the situation. The shallow breathing and pallor were only symptoms of too light an anæsthesia.

The few cases, in which jaw spasm is absent, are apt to give one a little difficulty ; in these, of course, the breathing and corneal reflex must be looked to for help, and such symptoms as phonation, movements, or swallowing will guide. I may say here that I always like the operation to commence with the loss of the corneal reflex, the surgical stimulus rouses up all reflexes which might otherwise be merely dormant.

Loss of Consciousness.—Towards the end of the first stage, the patient's perceptive faculties are becoming dulled, there is, therefore, very seldom any conscious resistance to the close application of the towel. The patient does not realise what is happening, otherwise he might easily be alarmed. Patients, who have had chloroform before, have told me afterwards that this induction was the quickest and pleasantest they have experienced.

Consciousness is, of course, completely abolished early in the second stage with very few exceptions, and if the sequence is properly carried out, does not return during the third stage, although, as pointed out above, there may sometimes be a little phonation and movements in response to the surgical stimulus.

I have so far said nothing about the pulse, because, having only two hands, I have been unable to make a series of accurate observations. Speaking in a general way, I have found the state of the circulation good, the heart's action being, I believe, stimulated by ethyl chloride.

An analysis of the 200 cases shows the following :—There were 43 male adults, 66 female adults, and 91 young persons under 16 years of age ; sex not noted. The youngest patient was 4 months and the oldest 73 years, the average age being 20 years.

The smallest quantity of C.E. administered during the first stage was ʒss, the largest ʒiv, the average amounted to ʒ1·9. The smallest dose of ethyl chloride was 3 c.c., the largest 8 c.c., and the average 5·17 c.c.

The duration of the first stage was, in the shortest instance, ¼ of a minute, in the longest 3 minutes, the average was 1·1 minutes.

The second stage lasted from a quarter of a minute, the shortest period, to four minutes, the longest, the average duration being one minute. Hence it will be seen that the average time taken in the induction of anæsthesia was about two minutes, though to this there are some few exceptions, there being 20 cases out of the 200, in which the corneal reflex was not lost at the end of the second stage.

Of these 20, some were quite sufficiently anæsthetised for the operations to proceed, a few, however, required a very free administration of chloroform, and took some minutes longer before they were ready. As I have stated before, the corneal reflex frequently returns during the third stage, but without return of consciousness. Of the 180 cases in which it was lost at the end of the second stage, I have definitely noted that it returned in 92, and did not return in 81, these latter being mostly children. In the remaining seven cases, I have no record.

The conditions as regards jaw spasm, I find, I have omitted to record in eight cases. In 108, there was the normal tight clenching. In 17, it was absent ; in 26, slight, and in 39. marked. In one case, the jaw was fixed with the mouth widely open, and in one, jaw spasm did not appear till well on in the third stage, and was then well marked.

Of course amongst these cases there have been several deviations from what I may call the normal induction. I have not time to give the notes of all these abnormal cases, but will briefly refer to a few.

There was only one case in which any alarming symptoms set in during the induction. This was a man, aged 44, with mitral stenosis, who had also a very receding chin and prominent pomum Adami.

At the commencement of the second stage, he had some struggling, followed by muscular spasm, and as this threatened to involve the respiratory muscles, and a slight blueness was becoming apparent, I immediately abandoned the method, gave him a few breaths of air, and afterwards continued slowly with C.E. I should not feel disposed to give ethyl chloride to this type of patient in the future.

There have been a few cases in which, although the corneal reflex has been lost satisfactorily at the end of the second stage, it has returned very quickly, and with it some struggling, perhaps a little retching, and a state of semi-consciousness. These have generally been hysterical women or alcoholics. In some of them, the preliminary doses were too small, or there had been a little difficulty in the close application of the towel during the second stage.

In one or two cases, I have noted that the breath was held for an abnormally long time at the commencement of the second stage. In a few, jaw spasm has been very prolonged, lasting throughout the operation. In some few there has been free perspiration.

Taking everything into consideration, I have got to like the sequence, and now adopt it as my routine practice. There is undoubtedly a great saving of time, and with this nothing to unduly alarm a nervous patient. It suits children admirably, they are generally under in between one and two minutes, with the minimum of discomfort.

By watching the behaviour of the patient during the second stage, one very quickly has a rough guide to the dosage of chloroform suitable to the case later on. There is no danger of the patient merely falling into a condition of anæsthetic slumber, especially if the operation commences, as it should, at the end of the second stage. Owing to its precision, I think it safer than the ordinary method of inducing anæsthesia on a mask.

EXTRA-UTERINE GESTATION.

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Ever since the middle of the 11th century, it has been known that the ovum could be fertilised and grow outside the uterine cavity, for it was about that time that Albucasis described the first known case of this condition. Parry, who wrote a remarkable book on the subject in 1875, speaking of rupture and intra-abdominal hæmorrhage, said: "In the whole domain of surgery, for we can not look to other than surgical measures in the circumstances, there is now left no field like this. The only remedy that can be proposed to rescue a woman, in these unfortunate circumstances, is to open the abdomen, tie the bleeding vessels, or to remove the sac entire." It was not, however, until some eight years later, that is to say, in 1883, that Lawson Tait first operated for tubal rupture. When ovulation takes place, the normal course is as follows:—

A Graafian follicle undergoes maturation, that is to say, it gets nearer to the surface of the ovary, at the same time increasing in size. Soon after it reaches the surface it bursts, and the ovum escapes. The latter finds its way into the Fallopian tube possibly aided by the fimbriæ of the tube, especially by that which is attached to the ovary, and which is called the tubo-ovarian fimbria. It is propelled along the tube to the uterus by the action of the ciliated epithelium which lines the tube. Should it become fertilised, either in the tube, or in the uterus, an embryo is developed, otherwise it probably passes out with the menstrual discharge.

If, however, when the Graafian follicle ruptures, it does not escape, but remains in the cavity, and whilst there is fertilised by a spermatozoon, which has found its way up the Fallopian tube, a condition known as ovarian fœtation is set up. For a long time the possibility of this occurring was denied, but repeated cases have shown that such a condition is possible, but very uncommon. Altogether there have been some eight or nine cases reported of this condition, but that by Kelly and McIlroy is perhaps the most complete and interesting.

The woman, aged 33, had been married 12 years, and had had five children, the last two and a half years previous to admission. There was nothing to note about previous labours or puerperia. Menstruation was regular. At the beginning of December 1904, not having menstruated for six weeks, she was suddenly seized with severe abdominal pain, accompanied by shivering but no vomiting. Next day menstruation came on and lasted three days, then there was an interval of four days, and again a loss for four days, followed by a fortnight's cessation, and then again menstruation.

On Examination.—The cervix was somewhat large and soft. The uterus was mobile, and not much enlarged. The left appendages were large and tender, and filled up the left side of the pelvis. No tumour could be felt on the right side.

Operation.—Laparatomy was performed, and the left ovary was found to contain a blood cyst, the size of a plum, which was removed. Recovery uninterrupted.

That the pregnancy had occurred within a Graafian follicle was proved by the presence of the lutein cells. There were no decidual cell elements present, either in the ovary or in the tube. This case, at the time of the operation, was not regarded as one of ovarian fœtation, but was thought to be simply a blood cyst of the ovary.

It has been said that such cases are liable to be confounded with cases of tubal gestation, which have ruptured in between the layers of the broad ligaments, and have gone on growing, the ovary becoming stretched out over the surface of the sac.

Now, in the first place, an ovarian fœtation will never reach any great size without rupturing, because the substance of which the ovary is formed does not tend to stretch well, and, in the second place, in cases of intra-ligamentous rupture, the tube is never found free, and, in most of the reported cases of ovarian fœtation, this point has been made out.

Primary abdominal fœtation is exceedingly rare. Here the Graafian follicle ruptures, the ovum escapes, and becomes impregnated in the peritoneal cavity, and remains there or is possibly fertilised *in situ* in the follicle, and afterwards drops out into the peritoneal cavity, and becomes attached either to the intestines, or some part of the pelvic peritoneum. One case, reported by Galabin in the *Transactions of the Obstetrical Society* in 1896, seems to belong to this variety. Rupture took place at seven weeks' gestation, and the woman died after operation—an embryo $\frac{5}{8}$ inch in length was found. The sac was attached to the bottom of Douglas' pouch and to the back of the uterus and broad ligaments. Both tubes were free and pervious. It is possible that some of the cases, described as primary abdominal, are in reality cases of tubal gestation, occurring in the ampullary portion, which have early aborted through the fimbriated extremity, dropped down into Douglas' pouch, become adherent to the peritoneum, and gone on growing.

We now come to the most common form of extra-uterine gestation, namely, tubal. For some reason, or reasons, which I will discuss presently, the fertilised ovum fails to reach the uterine cavity, and remains in the tube. It may become arrested at the fimbriated extremity, in which case it is called tubo-ovarian, tubo-abdominal, or ampullar pregnancy, or it may develop in the isthmial portion known as isthmial pregnancy, or, lastly, it may become arrested just at the junction of the Fallopian tube and the uterus, and develop in that portion of the tube which is contained in the uterine cornua, being then known as an interstitial or tubo-uterine pregnancy.

This last is probably the rarest form, and in this the gestation sac is actually embedded in the uterine wall, and causes asymmetry of that organ. Rupture is supposed to occur somewhat later in this variety, in consequence of the thicker walls of the sac, but always occurs before the fifth month. It may burst in two directions, rarely into the uterine cavity, and so be discharged like an ordinary uterine conception, or, more commonly, into the peritoneal cavity. The latter is a very serious accident, for the large vessels in the uterine wall are torn, and hæmorrhage is consequently very severe. This condition is apt to be confounded with the next variety, which I am about to describe, viz., that occurring in the rudimentary horn of a uterus bicornis. This deformity is the result of failure of development of the mullerian ducts. If both ducts coalesce, but fail to communicate, a uterus duplex, or uterus bicornis, is produced. If only one duct grows, and the other remains stunted, a unicorn uterus is the result, the immature cornu being attached to the fully-developed horn near the upper part of the cervix. The ovary, on the same side, is often ill developed. The round ligament can be traced to the rudimentary horn, outside of which is the tube.

In a well-formed uterus bicornis, pregnancy may take place in either horn or both. If in one, a decidua forms in the other, and both are enlarged ; but if an impregnated ovum lodges in the rudimentary horn of an unicorn uterus, the consequences are more serious. It may rupture at any time between the second and the ninth month, or at full term, an ineffectual labour may lead to its death and subsequent mummification.

The clinical signs of gestation, in a rudimentary horn of a uterus unicornus, are the same as those of tubal pregnancy. The position of the round ligament is of importance in recognising the difference, either at the time of operation or at the post-mortem, between tubal interstitial and cornual pregnancy. Normally, the round ligament springs from the upper angle of the uterus immediately in front of the tube.

In tubal gestation, the round ligament is attached to the body of the uterus on the uterine side of the gestation sac. In cornual pregnancy, the round ligament is attached on the outer side of the gestation sac, whereas, in interstitial, it may be attached to the front of the sac. The close incorporation of the sac with the rest of the uterus, and the absence of the separate horn, will help to distinguish the interstitial from the cornual pregnancy. This condition may also be mistaken for a uterine fibroid.

Another interesting point in connection with cornual pregnancy is this. In nearly all the recorded cases, the gravid rudimentary cornu was attached to the well-formed cornu by a solid fleshy pedicle, but no channel of communication could be found, in this pedicle, between the gravid rudimentary horn on the one hand, and the cervix, or well-developed horn, or the vagina on the other, so that the question arose as to the possibility of an ovum, that has entered the rudimentary horn, becoming impregnated. The only explanations offered are these : Either that the spermatozoon has impregnated an ovum belonging to the ovary of the opposite side, and that this ovum has then migrated across the pelvis and entered the other tube, a somewhat hypothetical suggestion ; or that, originally, there was a channel of communication in the stalk of the rudimentary horn, and that this becomes occluded subsequent to pregnancy.

In isthmial pregnancy, the ovum becomes implanted and grows in the middle third of the tube. During the first month or six weeks, the tubal tissues are swollen and turgid. Occasionally, at the site where the villi are implanted, the wall becomes thin. The cells of the villi make their way through the muscosa, and become implanted in the muscular coat; in fact, it has been shown, in some early cases of tubal pregnancy, that the fertilised ovum may entirely encyst itself in the muscular wall of the tube.

In some cases, occlusion of the ostium abdominale takes place, but this is a somewhat slow process, and probably requires about eight weeks for its completion; in others, dilatation occurs, and this predisposes to the condition known as tubal abortion. Tubal abortion, however, more commonly occurs in those cases in which the pregnancy is situated in the ampullary part of the tube. Before describing the varieties of rupture which take place in isthmial gestation, it is necessary to say a few words about tubal mole.

The formation of this tubal mole is due to repeated intratubal hæmorrhages, and the hæmorrhage takes place round about the chorionic villi surrounding the ovum, and also into the space between the amnion and the chorion called the subchorionic space. That hæmorrhage, which is found in the subchorionic space, is supposed to be fœtal in origin, owing to the fact that the red blood corpuscles are nucleated. That which occurs among the villi is, of course, maternal in origin. If a tubal mole is examined, it will be found to be composed externally of laminated blood clot, intimately blended with the chorion and its villi, then, either in the centre, or more usually at one end, will be found a smooth-lined cavity, the amniotic cavity filled with albuminous fluid, and perhaps a fœtus *in situ*, or if not the fœtus, perhaps some portion of the umbilical cord. Sometimes, however, the amniotic cavity has been ruptured, in which case all trace of the embryo will have disappeared, and it is only by microscopical examination and the finding of chorionic villi, that a definite diagnosis can be made. Rupture, in the case of a tubal gestation, usually occurs before the end of the third month, most commonly between the sixth and tenth week; when it does occur, the tear may be so situated that the ovum escapes into the peritoneal cavity, or in between the layers of the broad ligament. The latter is the more common variety, when the ovum is fertilised in this portion of the tube, and it is known as intra-ligamentous, or extra-peritoneal rupture.

Sometimes, when rupture occurs, the ovum is already dead, a mole having formed, such as I have just described, or the attachment of the ovum to the tube may be broken down by the rupture; in which case, the ovum may die, or the attachment may not be interfered with, and the ovum will go on living. When the ovum dies, or is already dead, at the time of rupture, there is an extravasation of blood into the broad ligament, known as a pelvic hæmatoma, and, on examination, a tumour is found occupying the whole of the broad ligament, and pushing the uterus over to the opposite side. As a rule, in such a case, the blood is absorbed, but it may become infected with pyogenic organisms, and form one variety of pelvic abscess. Occasionally, however, the hæmorrhage is severe, the peritoneum is stripped up, both in front and behind, and, unless some operative form of interference is undertaken, the patient will bleed to death.

When the ovum has gradually eaten away, or eroded through the wall of the tube, and is slowly extruded through the rent into the cellular tissue between the layers of the broad ligament, owing to its retaining a large portion of its attachment to the tube, it goes on growing, and what is known as a mesometric pregnancy is formed. The sac is then formed, partly by the dilated tube, and partly by the anterior and posterior layers of the broad ligament. In its growth, it strips up the peritoneum, and this may go on until full term; but, as a rule, the peritoneum gives way, and secondary rupture takes place, usually about the middle of pregnancy. This condition is a serious one, and may cause the death of the patient from hæmorrhage, unless there is operative interference.

The situation of the placenta is a very important factor in these cases; if it is situated above the ovum in the upper part of the Fallopian tube, when primary intra-ligamentous rupture takes place, it retains its attachment to the tube, and hence the ovum has the best immediate chance of living. The remote consequences, however, are much more severe, for should secondary rupture occur into the peritoneal cavity, it is certain that a portion of the placenta will be dislodged, and some large vessels torn, and there will be very considerable hæmorrhage. When the placenta lies below the fœtus, the latter, as it grows, pushes the former down against the pelvic floor, where it has a firm attachment, and is not so likely to be involved in a secondary rupture. If secondary rupture does not occur, the fœtus dies, and undergoes either mummification or calcification, or, if infected with bacilli, will form an abscess, which may burst either into the intestinal canal, the rectum, the vagina, or the bladder, or externally through the abdominal wall, and portions of the fœtus may go on being discharged for some time. If calcification takes place, what is known as a lithopædium is formed, which may remain quiescent for months, or even years, and never cause any trouble. Many remarkable and interesting accounts of this have been published.

In 1814, Cheston described a case in which an extra-uterine fœtus had been retained for 52 years in the abdomen. A portion of the specimen is in the College of Surgeons' Museum. In some instances, the entire fœtus has sloughed through the abdominal wall, and, in one case reported in the *Philosophical Transactions*, the fœtus was removed by a butcher, and the account of the case ends in this way :—" The woman recovered, but there was a navel rupture, owing to the ignorance of the man in not applying a proper bandage."

Lastly, we come to the variety known as ampulla pregnancy, and with this must be described that interesting condition, tubal abortion.

In ampulla pregnancy the ovum becomes implanted in the outer third of the tube. If it is close to the abdominal ostium, it is sometimes called an infundibular pregnancy. There are three possible terminations to this form of gestation :—

First. It may rupture, and, if it does so, the rupture is always intra-peritoneal, and for the reason that the tube, during the latter part of its course, is not contained within the layers of the broad ligament, so that this naturally is a very severe termination.

Second. Tubal abortion may occur, and the ovum be partially or wholly extruded through the ostium.

Third. The tube may stretch sufficiently to allow the gestation to go on to full term.

Tubal abortion is, however, that of which I particularly wish to speak. The ovum, growing in the outer part of the tube, prevents the closure of the ostium abdominale, and the abortion itself usually occurs during the first or second month. It may be entirely expelled into the peritoneal cavity, or a part of it may remain attached to the infundibulum. Its expulsion is due to the contraction of the muscular fibres of the dilated tube attempting to get rid of what is to them, of course, a foreign body. Sometimes the ovum is expelled entire, and without injury to itself, but more often a tubal mole is formed in the process of expulsion. In conjunction with this is found a collection of blood in the pouch of Douglas, known as a pelvic hæmatocele, which is due rather to a constant leaking of blood from the tube into the pouch than to a sudden hæmorrhage, as in rupture.

We have now to consider the causes of an extra-uterine gestation. Before attempting this, it is necessary however to consider what is the normal site of fertilisation of the ovum. There are three chief views :—

First, that normally the ovum is always fertilised in the uterus ;

Second, that it is always fertilised in the tube ; and

Third, that it may be fertilised at any point on its way between the Graafian follicle and the cavity of the uterus.

Lawson Tait's view, that the uterus alone was the seat of normal conception, and that the function of the ciliated lining of the tube was to prevent spermatozoa from entering it, was strengthened by the belief, which existed in his day, that the cilia in the tube and uterus acted in opposite directions ; those in the tube waving towards the uterus, and those in the uterus waving towards the fundus. In accordance with this idea, he looked for the cause of extra-uterine fertilisation in any condition which destroyed the ciliated epithelium. However, it was proved, some years later, that the action of the cilia is the same in both cases, namely, from the ostium abdominale to the cervix. Furthermore, spermatozoa have been found in the tubes after extirpation, in which there was no tubal disease.

The second view is that strongly held by some German writers, who consider that fertilisation takes place probably at the fimbriated end of the tube, and immediately after the exit of the ovum from the follicle. If this is so, every pregnancy commences as an extra-uterine, which is a little difficult to believe.

Assuming then that the third view is correct, viz., that the ovum may be fertilised either in the uterus or the tube, it is necessary to next consider what are the causes which prevent it from reaching the uterine cavity in those cases in which it is fertilised in the tube.

They are hypertrophy of the tubal mucous membrane, diverticula of the tube, exaggerated convolutions and cicatricial contractions, or obstruction by bands of adhesions, pressure from tumours, such as a fibroid in the wall of the uterus, and, lastly, tumour in the tube, such as a small polypus, as was present in a case reported by Duhrssen, which exercised a ball-valve action. Something more must be said about the condition of the mucous membrane, for, by some people, this was regarded as a very important factor. If the woman had had a previous attack of salpingitis, and the mucous membrane was in consequence denuded, it was supposed that there was nothing to impede the spermatozoa from travelling up the tube, and this, no doubt, was perfectly right, but, if the mucous membrane is in a damaged condition, it is scarcely likely that it would be a suitable ground for the ovum to take root upon and grow.

Another argument which has been put forward in favour of the cause in those women who have previously borne children, is that the tube, like the uterus, in some cases undergoes puerperal atrophy, or, in other words, super-involution, and that the walls are consequently thin, and the mucous membrane damaged, so that the ovum is not actively driven along towards the uterine cavity.

Lastly, Ballantyne has put forward the following theory :—

The trophoblast is recognised as a means by which the fertilised ovum becomes normally attached to the mucous membrane of the uterus. Should the fertilised ovum be detained in the tube until the trophoblast is fully formed, or should the trophoblast be formed prematurely, then it may become attached to the mucous membrane of the tube. This requires a little explanation.

The trophoblast is the name given to the cells, which form the outer, or epiblastic, layer of the chorionic villi, that is before the meso-blastic structure grows up into the villi, and these cells, or trophoblast as they are called, appear to exert upon the decidua some absorptive influence, which enables them to form the depressions in which they are placed.

Before describing the symptoms and diagnosis, it is necessary to remark upon the very important part played by the uterus in this condition. In all cases of extra-uterine pregnancy, the uterus becomes enlarged, but its shape remains pyriform, and does not become globular in outline, which is so characteristic of the pregnant uterus in the early months. The consistence also is different, as the organ is usually not so soft as in an intra-uterine gestation. The position is altered, being pushed over, as a rule, to the side opposite to the extra-uterine. The most important change, next to the size, is the formation of the decidua.

This resembles the decidua vera, formed in a uterine pregnancy. When it is expelled in one piece, it is triangular in shape, the base of the triangle corresponding with the fundus, and the angles at the base with the Fallopian tubes ; the outer or uterine aspect is rough and shaggy, the inner or free aspect smooth. It may be expelled at any time during the progress of the gestation, but it is particularly liable to be expelled at the time of rupture, or at full term, if the ovum lives to that time, and it may be expelled either whole or piecemeal. If the fœtus should go on living until full term a spurious labour occurs, the cervix dilates, and the decidua is cast off, and then the fœtus dies.

With regard to the changes which occur in the tube, a great deal of discussion has been, and is still going on. There is no doubt about this one point, viz., that decidual cells are found in the tube ; whether they are present only in cases of tubal gestation, or whether they are always present, both in cases of intra- and extra-uterine pregnancies, is still a matter of doubt. A suggestion has been put forward that this decidual formation in the tube is the direct cause of the pregnancy, that is to say, that, in those cases in which decidual cells are formed in the tube, tubal gestation is more likely to occur.

In discussing the symptoms, diagnosis, and treatment it is best perhaps to divide the description into three phases:—

1. Before rupture of the gestation sac.
2. At the time of rupture.
3. After rupture.

The special symptoms of extra-uterine gestation before rupture of the sac are very often entirely absent, and the usual symptoms of intra-uterine pregnancy are present. One point, however, upon which great stress should be laid is that of the menstrual history. The patient may have the usual amenorrhœa from the time of impregnation, or she may have menstruated regularly up to the time of rupture, or, most probably, she may have missed a period, and then had irregular hæmorrhage.

This irregular or, in some cases, continuous hæmorrhagic discharge may be due to the detachment of several pieces of the decidua, which has formed in the uterine cavity, or, in some cases, of tubal mole, it has been thought that the blood escaped from the uterine end of the tube into the uterus; very rarely a complete decidua is expelled previous to rupture.

The next important symptom is pain. This is irregular, and also intermittent, sometimes felt in the lower part of the abdomen, sometimes in the back, more commonly in the former. The pains may be due to irregular uterine contraction, but are quite likely also caused by the contraction of the muscular fibres in the gestation sac.

The physical signs are more definite. The usual signs of pregnancy are to be found, including activity of the breasts and enlargement of the uterus, but none, as a rule, so well marked as in an intra-uterine gestation. The shape of the uterus, as already mentioned, is less globular and more pyriform. In a favourable case, it is possible to detect the enlarged tube, by means of a bimanual examination, at any time after the fourth week, when it is felt as an oval swelling on one or other side of the uterus, or in Douglas' pouch, whilst the uterus itself is pushed over towards the opposite side. The tumour also may be felt to pulsate.

In interstitial pregnancy, the tumour is incorporated with the uterus; in isthmial, it is just possible to determine that the swelling is not incorporated with the uterus; whilst in an ampullar pregnancy, the swelling is connected with the uterus by a pedicle, formed of the inner portion of the tube.

The diagnosis is aided sometimes by two further points; first, that the cervix is not so markedly softened as in intra-uterine pregnancy; second, that Hegar's sign of pregnancy, that is, the softening of the lower uterine segment, is absent.

The chief points, then, to go upon in this stage are these:—That a woman, who has been previously quite regular, misses a period; soon afterwards she suffers from pelvic or abdominal pain. On examination, preferably under an anæsthetic, an enlarged tube is found. If there is no history of old tubal disease, or any fact suggesting septic endometritis, or gonorrhœa, then the diagnosis is certainly in favour of a gravid tube.

The treatment is laparotomy, and removal of the tube as soon as possible. It has been performed by the vaginal route, but, in this country at any rate, the abdominal route is usually chosen.

The operation consists of ligaturing the tube close to the uterus, removing the outer portion, and repairing the broad ligament. All such procedures as injections of morphia and other fluids into the sac, or the use of strong electrical currents, with the object of killing the fœtus, must be condemned as unscientific.

The chief symptoms, at the time of rupture, are pain and hæmorrhage. The patient complains of a feeling as if something had given way, and this is followed by continuous and violent abdominal pain. The amount of blood lost depends a good deal upon whether the rupture is intra- or extra-peritoneal. When it is the latter, the symptoms generally are less severe, because the pressure exercised by the blood, extravasated between the layers of the broad ligament, tends to check the hæmorrhage. But where the rupture takes place into the peritoneal cavity, whether it is a primary or secondary rupture, the symptoms and signs are much more serious. The patient is collapsed and blanched, with a rapid and thready pulse, and a subnormal temperature. She is restless, and has an anxious expression, and there is often vomiting. The respiration is sighing, and the voice is reduced to a whisper. In severe cases, death may ensue in a few hours. The abdomen is tender, and usually tympanitic, and the recti contracted, preventing anything from being easily made out by palpation.

Bimanual examination may reveal nothing, except perhaps that the uterus is enlarged, and that, if a definite swelling has been previously felt on one or other side of the pelvis, it may now have disappeared.

In fact, both abdominal palpation and bimanual examination should be avoided as much as possible, unless preparation has been made to open the abdomen immediately, as the manipulations may only increase the hæmorrhage.

The physical signs of rupture, when the bleeding is slight, and when a hæmatocele is forming, are more definite. In such cases, a boggy tumour can be felt in Douglas' pouch, which completely fills up the pouch, and bulges downwards and forwards into the vagina, and, if a finger is passed into the rectum, the latter will be found flattened out, and the enlarged uterus will usually be felt anterior, displaced forwards by the hæmatocele.

The signs of an extra-peritoneal rupture are also fairly definite, for, on vaginal examination, a round ill-defined swelling will be detected on one side of the uterus, and, when there is much blood effused, that organ will be displaced to the opposite side; sometimes the blood may extend posteriorly round the rectum.

An intra-peritoneal rupture has to be diagnosed from lesions of any other abdominal or pelvic viscera, such as perforating gastric duodenal, or intestinal ulcer, appendicitis, or renal colic. The two chief points which are of special help are:—

1. A history of some irregularity of the menses.
2. The presence of a blood-stained vaginal discharge.

From threatened abortion, it can only be diagnosed by bimanual examination, and finding the adnexa normal.

Treatment.—In all cases of diffuse hæmorrhage, whether intra- or extra-peritoneal, arrangements should be made for opening the abdomen, and ligaturing and removing the ruptured tube. This is fairly simple in a primary rupture, but in a secondary rupture is a much more difficult matter because of the placenta.

It is possible that the symptoms of rupture may be so slight as to pass unnoticed, and the fœtus may then go on growing, and give rise to no special symptoms, and so the woman arrives at full term quite unconscious that anything is wrong. Usually, however, the special symptom which is noticed is that the movements of the fœtus can be felt very easily by the patient, and also that they are accompanied by some pain.

On abdominal palpation, the movements of the fœtus and the fœtus itself can be felt more readily than usual, and a tumour, which is the empty uterus, can sometimes be felt to one or other side, and, on vaginal examination, the cervix is not so soft as in a normal pregnancy. The diagnosis is often aided by the fact that positive signs of pregnancy may by this time be present, viz., fœtal movements, fœtal parts, and fœtal heart-sounds.

The treatment of extra-uterine gestation after rupture depends somewhat upon how far the gestation has advanced, and whether the fœtus is alive or dead.

The chances of the fœtus ultimately surviving, should the pregnancy go on to full term, are remote. It usually dies at the time of rupture.

If it has not advanced beyond the fourth month, it may be possible to remove the ovum entire, but where it has advanced beyond this time, it is best to open the abdomen, incise the sac, and remove the fœtus. If the placenta is situated in the upper part of the sac, it may be possible to ligature its attachments and remove it, but if it is situated low down in the pelvis at the bottom of the sac, it may be left, and the edges of the sac stitched to the abdominal wall, and a subsequent attempt made to remove it in about a fortnight, or sometimes the sac has been closed up and the placenta left altogether. This refers, of course, to a case in which the fœtus is living at the time of the operation, and the object, in leaving the placenta *in situ* for a fortnight, is to allow the maternal vessels to shrink, and so diminish the risk of hæmorrhage in removal.

DISINFECTION AND DISINFECTANTS.

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Distinction is properly drawn between disinfectants, antiseptics, and deodorants, the last two not necessarily being germicidal, while true disinfectants are so.

Disinfectants are either physical or chemical in nature.

I. Physical disinfectants include :—

1. Actual combustion.
2. Moist heat :—
    - (*a*) boiling.
    - (*b*) steam (current, saturated, superheated).
3. Dry heat.
4. Filtration (through various forms of filters), such as cotton-wool, sand, porcelain, infusorial earth, etc.

II. Chemical disinfectants are many in number. These are what are generally understood by the term "disinfectants." They include a large variety of substances which, in certain strengths, are germicidal, while, in weaker solutions, they are merely antiseptic.

Dealing first, very briefly, with physical disinfectants, the application of fire or flame is of course the surest and speediest method of disposing of infected material, but as it is often destructive of the material, as well as of the infecting agent, it is naturally reserved only for such articles as are indestructible by fire, or are no longer required, or which can be easily spared. In the form of cremation, it may be regarded as the most satisfactory method of disposal of the bodies of persons, or of animals dead of an infectious disease.

The method of disinfection by boiling is one of the surest and simplest available. It involves no expensive or corroding apparatus or drugs. It is applicable, in some form, in every household, and is probably the best form of disinfection to be adopted for infected linen, china, plate, and other articles which permit of boiling. It is applicable for the disinfection of such articles in all the common infective diseases of mankind.

For large articles, such as mattresses, pillows, etc., the most efficacious method of disinfection is by steam in a properly constructed steam disinfector. Molecular changes occur when water is heated to 100° C. under ordinary atmospheric pressure, the water becoming converted into steam.

This vapour condenses, on coming into contact with cooler bodies, and, at the same time, gives off a large quantity of latent heat. When the atmospheric pressure is increased, the boiling point of a liquid is raised, and the liquid does not then become steam until this higher temperature is reached. Steam, at any pressure, is "saturated" when it is at the boiling point of the liquid for that particular pressure. If, however, such saturated steam is further heated, it is known as "superheated" steam. In other words, it has become, for all practical purposes, converted into a gas, that is, the vapour of a liquid, of which the boiling point is substantially below the actual temperature of the gas. Now, whereas saturated steam can condense without cooling, superheated steam cannot so condense, and give out its latent heat, until its temperature falls. As a disinfecting agent, therefore, saturated steam has more penetrative power than superheated steam, and is consequently superior in its effect.

The penetrating power of steam is increased by intermitting the pressure during the disinfection.

The standard disinfecting temperature, at present employed, is saturated steam, at 115° C., for a period of half an hour, this standard being based on the destruction of the most stable infective matter known. In order to ensure absolute disinfection, a recording diagram should be attached to each steam disinfector to indicate freedom from air, a sufficient temperature and sufficient length of exposure. Steam disinfection is most usefully provided by a Sanitary Authority at a proper disinfecting station, suitable separate vans being employed for the removal and return of the articles before and after disinfection.

Dry heat is nowadays but rarely used, and then only for articles which will not permit of disinfection by steam. For some years, it has been practically replaced by one of the aerial methods of chemical disinfection yet to be mentioned.

The last physical method of disinfection I shall refer to here is that by means of filtration. On a large scale, this is applied to water supplies by means of sand filters. On a small scale, by means of various domestic filters, including such materials as sterilised cotton-wool, carbon, iron, natural porous stone, porcelain and other clays, and compressed siliceous and diatomaceous earths. Though by means of filtration, an infected liquid may possibly be quite freed of infective bacteria, the process after all has not been of a germicidal nature, but merely mechanical. For this reason, filtration methods cannot be classed under true disinfectants.

To turn now to chemical disinfectants. These are of the greatest importance as being the only methods available for many requirements of everyday occurrence. Houses, and furniture, and living bodies cannot be boiled or steamed, and destruction by fire is not generally desired.

(It is as well here to remember that a great fire in a city, which, at the time, may appear to be a dire calamity, may after all be the greatest blessing in disguise for the future of that city, as witness the Great Fire of London, and the subsequent extinction of the Plague.)

It is under the heading of chemical disinfectants that it is very desirable to appreciate the relative value, and thus be guided in the selection, of disinfectants.

In order to estimate relative values, it is absolutely necessary to have a standard as regards bacterial growth. Consequently, in testing disinfectants, it is essential—

1. To see to that all tests are comparative, and made under all similar details of experiment.

2. To make control experiments.

3. To remember that repeated cultivation of an organism, in the presence of an antiseptic, often results in changes of its biological properties (thus motility or the power of spore-formation may be lost).

4. To remember that the same organism has a variable resistance, according as to whether it is sporing or vegetative. The individual spores indeed vary in their resistance.

5. To remember that the virulence of an organism is influenced by the medium or other environment of its existence.

It is further essential to—(*a*) Filter the fluid culture of the organism in order to get the individual bacteria separated, otherwise the disinfectant may not reach the central members of a group.

(*b*) Have about the same number of bacteria in each experiment. This can be accomplished by dilution and counting.

(*c*) Carry out each comparative experiment at the same temperature. (N.B.—In every case, the temperature should be stated.)

(*d*) Use the same strain or race of organism.

(*e*) Keep subcultures for at least a month in the most favourable temperature and medium. This is because organisms may be merely attenuated, and take longer to grow. Mere attenuation may also explain negative experiments on animals.

The following methods of testing liquid, or soluble, disinfectants have been in vogue for some years :—

(1) Small pieces of thread, or filter paper, are first sterilised, and kept in a covered sterilised capsule : they are soaked in a bacterial suspension, and then placed in the disinfectant solution, each piece for a definite stated time. They are next soaked in sterilised distilled water (where the disinfectant is a mercurial salt, preferably washed with distilled water containing sulphide of ammonium or H_2S) in order to remove the disinfectant. Finally, each piece is sewn on the selected medium, and incubated at the chosen temperature, and the results duly noted.

(2) Measured quantities of a bacterial suspension, and the disinfectant solution, under trial, are mixed. At stated intervals of time, a loopful of this mixture is transferred to fresh sterile medium. This is incubated at the right temperature and the result noted.

The following methods are useful for testing volatile disinfectants :—

(1) An agar culture of an organism is prepared. The cotton-wool plug of this culture is then moistened with the disinfectant solution, and replaced in the tube, which is then covered with a rubber cap. The tube is then incubated. No growth should occur, if the solution is a true volatile disinfectant. (Care must be taken that the plug is merely *moistened*, not soaked.)

(2) Small pieces of sterilised linen, or thread, are dipped into a standard culture of an organism in broth at a standard temperature. These may directly, or after drying over sulphuric acid in a vacuum at 38° C., be placed in a gas-tight chamber containing the disinfecting gas. At stated intervals, cultures are made, and duly incubated and tested.

The standardisation of disinfectants was urged by C. G. Moor,[1] years ago, when he pointed out how extremely complex was the examination of any substance for disinfectant capacity. "The conditions which determine the death of an organism in the presence of foreign substances, or its cessation of growth, vary not only for different species, but also for different races of apparently the same species."

There was at that time (1896) "no means available for defining an exact standard by which the resistance of organisms to disinfection" could be measured. Moor suggested, therefore, that "to obtain some trustworthy datum, as to the action of a disinfectant upon a given species of organism, it is desirable, at the same time as observations are made upon the disinfectant under examination, to determine the strength and time of exposure required for the disinfection of the particular race, on which the examination is conducted, when subjected to other common disinfectants."

In order to obtain comparable results, expressible as coefficients, Ainslie Walker recommended the use of phenol as giving consistent results, and he further insisted on the importance of working with the same organism (THE PRACTITIONER, 1902, p. 523). Rideal and Walker showed (*Journ. of Sanit. Inst.*, 1903, p. 425) the need for a bacteriological test, since much depends upon the conditions, both chemical and physical, in which the disinfectant is employed. They pointed out that, in order to obtain regular consistent results, time must be taken as the constant, and strength of disinfectant as the variant, and showed that the following factors must be duly allowed for :—(1) Time, (2) age of culture, (3) choice of medium and reaction of same, (4) temperature of incubation, (5) temperature of medication, (6) variations in vital resistance of same species, or of different species, (8) proportion of culture to disinfectant.

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[1] Pearmain and Moor : *Applied Bacteriology*, 1896.

The last factor is the most important of all, while of almost equal importance is it to remember, as pointed out by Kenwood (*Public Health*, February, 1906), that, though the standardisation method of Rideal and Walker provides a desirable uniformity of procedure which is of help in the selection and purchase of disinfectants, it does not supply us with an absolute standard of the strength at which a disinfectant must be employed in actual practice, because it does not take into account the influence of the associated organic matter upon the potentialities of the disinfectant.

The method of Rideal and Walker, however, expresses quantitatively the results of such comparisons as were urged by Moor, permitting the disinfecting properties of a given substance to be stated in terms of a carbolic acid coefficient, when acting upon a particular germ, under stated particular conditions ; but the practical utility of the method might be limited by the particular conditions. It does not follow that because one substance is a better and more trustworthy disinfectant than another under certain conditions, that it will be so in *any* circumstances. Such a deduction is against the canons of logic, and, indeed, it has been abundantly proved to be chimerical.

Kenwood and Hewlett,[1] for instance, carried out experiments to test the resistance of the typhoid bacillus in its natural environment, in order to see to what extent the carbolic acid coefficient of certain disinfectants might vary, according as to whether or no the estimation is placed upon a practical basis. These experiments served to show that the difference in the efficiency of the disinfectants tested is not so great under actual conditions of practice, when the organism is dealt with in its ordinary organic environment, as when tested by the Rideal-Walker method.

In the testing of izal and cyllin, the coefficient was reduced some 60 per cent. and 40 per cent. respectively.

Major Fowler[2] found that, in the presence of a filtered emulsion of fæces and urine, the carbolic acid coefficient of mercuric chloride was reduced from 3,000 to less than 3 ; that of tincture of iodine from 18 to less than 1; while permanganate of potash came out of the test with much more distinction than many would give it credit for. Similarly, Klein (*Public Health*, October, 1906, p. 27) proved that the carbolic coefficient of chloros (hypochlorites) was reduced from 21·0 to about 2 in the presence of urine. Major Fowler's experiments (*loc. cit.*) indicated that the disinfectants, of the tar derivative series, did not show any very marked difference in the "phenol coefficient" figure, this result working out more favourably for this series than the previous experiments of Kenwood and Hewlett. As regards this group, the carbolic acid coefficient would appear then to have considerable trustworthy value.

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[1] *Journ. Roy. San. Inst.*, Vol. XXVII., No. 1.

[2] "The Working Efficiency of Some Disinfectants," *Journ. R.A.M.C.*, January, 1906.

It is, however, quite necessary that any disinfectant, to be efficient, should be easily miscible with water, form a homogeneous and permanent emulsion, and remain uniform in strength and efficiency. It must be able to penetrate organic matter, and possess a considerable stability against decomposition, as well as have a high disinfectant power. If a disinfectant combines with these necessary properties, the further advantageous properties of being non-toxic, non-corrosive, and pleasant to use, it is, *pro tanto*, a more desirable disinfectant to employ. Further, we must not forget that the margin of safety is a very important question. Having obtained the minimum amount of a disinfectant which is required to kill under standard conditions, for practical disinfection, probably at least double this amount ought to be used, if not a larger multiple. This was pointed out years ago by Wolf Defries, and has been emphasised since by Kenwood and Hewlett, and C. G. Moor, and others.

There is another point, which should be duly appreciated, and that is that the disinfectant value of a solution does not necessarily vary in direct relation to its concentration. On the contrary, for many agents there is a point beyond which increased concentration reduces the disinfectant capacity.

Though many experiments have recently been performed with the drop method of Rideal and Walker, forming the subject of many papers, to some of which I have already referred, it is interesting to note that so careful and authoritative a worker as Sheridan Délépine, after 1 years' experience, recommends[1] the "thread" method, or dry cultures method, as a general method whenever the relative practical value of various disinfectants is under inquiry. On the other hand, Firth and Macfadyan[2] consider the technique of the "thread" method to be so elaborate that, no matter what might be its merits, "its adoption as a standard procedure seems impossible." They consider, the "drop" method, both for general simplicity and facility of working, to be superior to the garnet and thread methods, the chief disturbing factor being variations in temperature. Somerville and Walker (*Public Health*, 1906, p. 387) also claim that uniform results can be obtained by this test when properly conducted. They deal in detail with the factors most likely to give origin to disturbance, and point out the pitfalls, which have attended on the work of some observers, and indicate how they can be avoided. They show how discrepancies may arise from lack of uniformity of original samples, and also from subsidence of the same sample.

Two grave sources of error are, lack of simultaneous contact of the control and postulant with the test organism, and lack of any attention to the temperature of medication. They insist (1) that the carbolic acid, used as control, should in all cases have been carefully standardised with bromine.

(2) That the medium should, if possible, be of uniform composition.

(3) That there is necessity for uniformity in the factor of temperature of medication.

(4) Upon the necessity for absolute sterility of all media, appliances, and diluents used.

They claim that all workers, who scrupulously follow the technique of the Rideal and Walker method, as laid down by the authors, obtain results completely concordant, and maintain that it is more than futile to introduce into a method of standardisation of disinfectants such impossible complexes as fæces.

In order to meet this difficulty to some extent, Wolf Defries has suggested the selection of an artificial medium, in which to incorporate the standard germ, which would offer at least an equal resistance to that of sputum and fæces.

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[1] *Journ. Roy. San. Inst.*, February 1907.

[2] *Ibid.*, Vol. XXVII., pp. 22 and 23.

The problem of the standardisation of disinfectants is evidently one of considerable difficulty and magnitude, requiring adequate means in the way of time, skill, experience, equipment, and (what is often overlooked) remuneration. It seems desirable that further experimentation should be undertaken, and, in due time, that the State should exercise control over the sale of disinfectants.

In illustration of the need for further experimentation, it may be mentioned that the routine Rideal-Walker method, as regards *broth* cultures, is not universally applicable. Thus, when disinfectants are being tested against the *B. pestis*, broth cultures have been shown to be inapplicable by Klein, Simpson and Hewlett,[1] and by Watkins Pitchford,[2] and agar cultures have been used instead for this organism. As suggested by Hewlett,[3] the results obtained by agar subcultures are not really comparable with those of broth subcultures. The disinfectant is more likely to act as an inhibitant in the solid media, and thus give an inflated coefficient value. Even at this date (July, 1905), Hewlett says[4]: "The data afforded by the method (of Rideal and Walker) must be accepted with caution if they are to be applied to practical disinfection." And again: "The suggestion that has been put forward of introducing the coefficient into tenders for disinfectants is not, in my opinion, yet justified, unless a test is made in the presence of organic matter as well, but how this is to be done is a question awaiting solution."

The foregoing will make it clear that the selection of a disinfectant is not so simple a matter as, at first blush, might appear. At present, such selection must be based chiefly on practical experience and judgment, after due consideration, of the particular application of the disinfectant in view. Thus when albuminous matter requires disinfection, mercuric perchloride would probably prove inefficacious, or at least untrustworthy. Yet, for other purposes, mercuric perchloride is one of the most powerful and trustworthy of disinfectants. Among other matters to be considered before selecting a disinfectant is the question, whether it has properties, which may militate against its use for a particular purpose.

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[1] *Lancet*, August 20, 1904.

[2] "The Efficacy of Various Disinfectants," *Government Rep.*, Pietermaritzburg, 1905.

[3] "The Standardisation of Disinfectants," *Pharmaceutical Journ.*, July 28, 1906.

[4] *Loc. cit.*

The selection of a disinfectant will, therefore, vary according as to whether it is desired for surgical purposes, for the surgeon's hands, or for the patient's wounds, or for diseased organs, or mucous membranes; or whether it is desired for the disinfection of inanimate things, such as the surgeon's instruments, or the operation table, or the towels and dressings, or the fittings and furniture, etc.; or whether it is desired to disinfect a room, or bedding, or wearing apparel, or linen, or excreta, or sputa, or putrefying solutions, or leather goods, or plate, or china, or cutlery, etc., or whether it is desired to disinfect stables, pens, vans, basements, boats, railway carriages, and other vehicles, etc.

It may be desirable to refer to a few of these: (1) Disinfection of the surgeon's hands. This, as demonstrated by Lockwood and others, is exceedingly difficult. Various toilettes have been suggested, and many disinfectants employed, but, perhaps one of the most trustworthy methods is, after thoroughly washing, and scrubbing the hands with soft soap and hot water, to adopt Schaeffer's hot-water alcohol method (96 per cent. spirit) which mechanically removes bacteria from the skin. In connection with infectious diseases, it is customary to somewhat vary the methods of disinfection according to the disease. Thus, in connection with typhoid fever, the excreta (urine and fæces) require special attention, being thoroughly mixed with a sufficiency of disinfectant, and allowed to stand for a time before being emptied into the drain. Milk of lime, chloride of lime, carbolic acid, and its congeners are largely used for this purpose. One of the most important points is the necessity for every person, who has to deal with the patient, whether the doctor, nurse, or ward attendant, to soak the hands in a suitable disinfectant solution directly after attending to any of the patient's needs, involving the touching of the sheets or personal contact. Bedding and other articles, used by the patient, require the strictest attention. The same remarks apply to cholera, and other forms of infective diarrhœa.

Disinfection in connection with scarlet fever has, until recently, been mainly aimed at the supposed infectivity of the peeling skin. It is now more generally recognised that at any rate, the later peeling in scarlet fever is probably non-infective, while, on the other hand, more weight is being attached to what the majority of investigators are convinced are the chief channels of infection, viz., late lesions of the mucous membranes, particularly affections of the nose, throat, and ear, among the sequelæ of scarlet fever. All discharges from these organs should be carefully collected on cotton-wool, mops, or rags, and immediately burned. The urine should also be disinfected as with typhoid fever. The same remarks apply to the discharges from small-pox and diphtheria patients.

For disinfection of the room after recovery, removal to hospital, or death, it is customary to disinfect, after closing all apertures and crevices, by means of an aerial disinfectant, among which formic aldehyde at the present time holds the favourite place. Extra precautions are generally taken in dealing with small-pox, the wall paper being removed and burnt, or vigorously sprayed with formalin solution. All bedding and wearing apparel are removed for steam disinfection, but, if very old and dirty, are burnt.

In dealing with plague, very special and detailed precautions are observed. It is customary to first employ an aerial disinfectant. After this, all articles and walls, ceilings, and woodwork, and furniture are well sprayed with formalin solution (1 gallon to 50 gallons of water). All sheets and wearing apparel are then removed in a wetted condition to be boiled or steamed. Inexpensive articles are burned. Every room in the house should be cleansed, and all courts and ashpits, or ashbins, watered with chloride of lime solution, or other trustworthy disinfectant solution. In dealing with phthisis, special attention should be given to all articles in use as well as to the lower six feet of the walls, the floor, and its coverings. A solution of chlorinated lime of the strength of 1½ ounces to the gallon is effective, and should be applied by means of a brush or spray to all walls and floors, from which, at any time during the illness, the sputum has not been efficiently collected and destroyed. In cases, in which the sputum has received careful attention, it will suffice to thoroughly wash floors and all painted surfaces with soap and water, while the lower surfaces of the walls may be rubbed down with crumb of bread, as suggested by Esmarch. Ordinary fumigation is evidently inefficient to deal with germs enclosed in a tenacious envelope of dried sputum. Savage (*Public Health*, August, 1906) has found kerol, in a dilution of 1·180, an effective tubercle bacillus germicide in dried sputum after an exposure of three hours. There is a growing feeling aganist mere aerial disinfection, and such methods are gradually being superseded, or at any rate, supplemented, by spraying or washing methods.

Germs have no abiding place in the air. They are particulate matter, affected by gravity, and tend in time to deposit on surfaces. Surface disinfection is, therefore, of primary importance, and this can best be accomplished by wet and mechanical methods. Preliminary aerial disinfection no doubt is of use in destroying stray germs in the air of a room, and many of the more superficial bacteria exposed on the surfaces. But, it is always advisable to supplement such preliminary attempt at disinfection by the more trustworthy method ot mechanical removal by spray, or washing, using by preference a disinfectant solution for the purpose. In practical work no disinfectant can be considered as satisfactory which does not perform its work within a reasonable time, say, half an hour to three or four hours.

At the risk of repetition, other points of importance in deciding on a disinfectant are :—

(1) It should be, if possible, non-poisonous to higher animal life.

(2) It should be relatively cheap.

(3) It should be readily soluble in ordinary water capable of forming a homogeneous and permanent emulsion or mixture.

(4) Its efficiency should not be materially affected by the presence of organic method.

(5) For such disinfectants as are used in the form of a solution, it is preferable if they can be used in the form of a soap.

Some disinfectants and antiseptics depend on their power of liberating nascent oxygen when in contact with moisture. Among these, we find chlorinated lime, sanitas, potassium permanganate, etc., and recently there have appeared some metallic peroxides under the names of "hopogan" and "ectogan." Then, again, there frequently appear on the market certain synthetic compounds, such as acetozone, or benzoyl-acetyl-peroxide, whose activity depends on the liberation of nascent oxygen when in contact with the tissues. Among other recent synthetic compounds, with germicidal properties, may be mentioned formaldehyde compounds, the organic peroxides, phenol derivatives, silver, mercury, and the halogen compounds. The tri-chlor-derivative of phenol is stated to possess twenty-five times the germicidal power of ordinary phenol.[1]

One last word. Amongst the public, a fallacious idea is frequently found to exist, that the placing of vessels of some advertised disinfectant in the sick room absorbs or neutralises all infection.

The false security, so engendered, may prove very mischievous, and it is of great importance that the public should realise that an infected room must be considered infected until, after the recovery, death, or removal to hospital of the patient, it has been followed by methods of disinfection, carried out under the supervision of the Sanitary Authority, or an efficient substitute for such Sanitary Authority.

But, whatever methods may be employed in the first instance, these should invariably be followed by the plentiful use of soap and water, aided by "elbow grease," for the washing of floors and other washable surfaces, and finally by free exposure of the apartment to sunlight and air. Water, sunlight, and fresh air are the powerful cleansing and disinfecting agents abundantly supplied by nature, and their powerful aid should never be neglected whatever other methods may also be adopted.

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[1] Davis, *Journ. Roy. San. Inst.*, Vol. XXVII., p. 563.

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CASE OF "HOUR-GLASS STOMACH."

By R. H. C. GOMPERTZ, B.Sc., M.R.C.S.,
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On January 7, 1907, the patient, a healthy-looking, unmarried woman of 43, was admitted to King's College Hospital under the care of Mr. Carless, to whom I am indebted for permission to publish these notes.

She complained that, for the last twelve years, she had suffered almost continuously from indigestion, and that, in spite of medical treatment and careful regulation of her diet, she not only could obtain no relief, but was steadily becoming worse.

Until August of last year, the patient had never experienced any pain on the ingestion of food, her chief trouble consisting in vomiting, sooner or later, after meals; she occasionally became free from this symptom, but, after a short period, it always returned, usually in an aggravated form.

About August 1906, she became much worse, and, for the first time, began to complain of abdominal pain, which was referred to the right hypochondrium, and which was usually relieved, but not entirely removed, by vomiting.

The patient has never been jaundiced, and nothing abnormal has ever been noted in connection with the urine. Except for the symptoms detailed above, the patient has always been healthy, and able to do her work as a servant. Latterly, she fancies that she has lost weight, and complains that she is becoming very weak.

One sister died, at the age of 32 years, of pulmonary phthisis; the family history is, in other respects, good. With regard to the vomitus, it has usually been watery, and somewhat large in amount, 2 pints or more being brought up; and has never contained any obvious blood, or "coffee-ground" material. On examination, the patient was not wasted, and, beyond some rigidity and deep tenderness in the right half of the abdomen, nothing was found. The urine was normal.

It was decided to open the abdomen, and, failing other indications, to perform a gastro-enterostomy for the relief of the vomiting.

On January 11, 1907, Mr. Carless operated. A longitudinal incision of about 6 inches length was made about 1 inch to the left of the middle line, and extending from the costal margin to the level of the umbilicus. The peritoneum was opened and the stomach brought out; this viscus was then found to be distinctly abnormal. It was hour-glass shaped, owing to a constriction a little to the right of its centre, the pylorus was also considerably narrowed, and there were signs of old ulceration near the pyloric end. The gastro-hepatic omentum was perforated just to the pyloric side of the median constriction by a rounded hole about 1 inch in diameter, and bounded by a thick edge. The great omentum had in it several similar perforations.

The omentum and transverse colon were turned up over the stomach and the transverse mesocolon was exposed. Here again a large hole was found of sufficient size to allow it to be utilised for the purpose of bringing the jejunum into relation with the posterior wall of the stomach. Clamps were next applied to the stomach and jejunum, and were held together by forceps in such a way as to hold these two portions of the gut in close apposition.

A large opening, about 3½ inches long, was made in the stomach, and the elliptical piece of mucous membrane, thus exposed, was excised; the jejunum was then similarly treated, and a lateral anastomosis was made by simple suture. The two muscular coats were united posteriorly, the mucous membrane of the stomach was joined to that of the jejunum, and finally the sero-muscular coats were sutured in front. Care was taken, at this stage, to prevent the mucous membrane from separating from the rest of the stomach wall, by occasionally passing through it the stitch which united the muscular coats.

A second, smaller, but otherwise similar, anastomosis was made between the jejunum and the pyloric half of the stomach. The operation was completed by repairing the holes in the great omentum, and stitching that structure over the lines of the two anastomotic openings. The lesion in the small omentum was similarly closed.

The abdominal muscles were sutured with buried silkworm gut stitches, the incisions in the skin and peritoneum being united with iodised catgut.

The patient stood the operation well, and although she was a little sick afterwards, never became collapsed. During the night, she was given two saline enemata of half a pint each, and she also had a ℥iv. coffee nutrient.

For the next two days, she was fed by nutrient enemata, consisting of ℥vi. of peptonised milk, one being given every six hours. On January 14, three days after the operation, she was given ℥iij. feeds of milk and water by the mouth, and these were given every two hours. The amount was gradually increased, and, a week after the operation, the patient was allowed bread and milk, custard, and other soft solids.

The skin stitches were removed on January 20, and the wound was found to be completely healed. On the following day, the patient was given a small quantity of fish, and, by January 31, she was taking ordinary diet without any ill effects.

She left the hospital on February 6, and, when last seen, was entirely free from any trouble. She has no dyspepsia, and the bowels act regularly and well.

Remarks by Mr. Carless.—In this case, the symptoms were so obviously characteristic of chronic gastric ulceration, and so indicative of exploratory operation, that one did not put the patient to the discomfort and trouble of examination by test meals, and by distension of the organ, whereby alone the hour-glass contraction could have been recognised. The condition found on operation was extremely interesting. The division of the stomach into two halves was very definite, the contracted portion between the two pouches not being much more than an inch in diameter, and the internal lumen, by means of which food could alone pass onwards, being probably not more than a half inch in diameter. The contraction of the pylorus was also very considerable. The most interesting feature, however, consisted in the apertures which existed in the peritoneal ligaments above and below. That above the stomach in the less omentum was directly opposite the contracted neck between the two pouches ; the only explanation one can suggest for its existence was the drag of the contracting horse-shoe ulcer which led to the constriction. Such an explanation, however, can hardly hold good for the large opening in the transverse mesocolon, although it may suffice to explain the origin of the opening in the great omentum, which was also in relation to the contraction, and nearly opposite that in the gastro-hepatic omentum, so that the narrow portion of the viscus was almost detached.

As to the treatment of the condition, it was obviously necessary to connect up the upper pouch of the stomach to the jejunum, so as to allow of the passage of food into the intestine, without the necessity for its passing through the double obstruction constituted by the gastric and pyloric constrictions. For this an ordinary gastro-enterostomy sufficed. What to do with the pyloric pouch was the question. Two things suggested themselves; either to remove it *in toto*, or to connect it to another portion of the bowel. To leave it untouched would certainly have involved fermentation of whatever passed into it, and the very fact, that the main current of food would be deflected through the new opening, would determine a greater degree of stasis within than before. Total removal of the portion seemed a somewhat unnecessarily severe procedure, and one decided therefore to make a second communication with the jejunum a little below the former. As but little food could get into this pouch, a large opening was not necessary; all that was required was one for drainage, and the second communication was consequently a comparatively small one.

Both of these artificial openings were made in exactly the same way; clamps of the Robson type, which were employed for the purpose, were brought side by side, and then openings were made and suitably stitched together. For this purpose, I employed, as I do for practically all my work, sulpho-chromic gut which had been iodised. No. 00 gut, which I generally use for such an object, is allowed to remain in the iodine solution for eight or ten days, and then kept dry in sterilised gauze; it is immersed in methylated alcohol immediately before use. I consider that the employment of the chromicised gut is better than the use of the raw material, as it is a little stronger and more lasting.

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Ever yours

James Paget.

LEADERS IN MODERN MEDICINE.

II.

JAMES PAGET.

[With Plate XI.]

JAMES PAGET, though one of the acknowledged leaders of the medical profession in this country, never held the same position as a surgeon that William Jenner held as a physician. He was learned in the lore of his craft, and he was pre-eminent as a teacher, and he would have been an ideal physician, but he was not what our forefathers would have called a "tall fellow of his hands." He had not the dash and brilliancy of touch that go to make a great operator. In this he resembled Brodie, and, like that great man, Paget made the fortune of two or three of his pupils by handing over to them cases for operation, which he did not care to undertake himself. His signal merit is that he was a pioneer of surgical pathology in this country, and his right place was the professorial chair rather than the operating theatre. He was honoured by the whole of his profession for his steadfastness in well doing, and the spotless integrity of his character. He was in the Roman phrase, *vir pietate gravis,* and his stern narrow face had something in it of ecclesiastical austerity.

His life has been so admirably written by himself, and by his son Mr. Stephen Paget,[1] that nothing has been left for any later biographer to do but to borrow whatever stones he needs from that quarry.

James Paget was the son of a brewer and shipowner, who was Mayor of Yarmouth in the early part of the last century. He was born in 1814, and received his early education at a private school in the town. Many losses prevented his father from sending him, like his three older brothers, to Charterhouse, and, as he says himself, "I have no doubt I thus suffered heavy loss. I learned as much as I could, and for the last year or more was the head boy in the school; and I did my best in after years to increase my 'school learning'; but I never could acquire anything fairly to be called classical knowledge: I could translate enough for the commonplace understanding of a Latin or Greek book, but never could acquire any classic taste, or enjoy the influence of any ancient writer, or take part in any of the learned table-talk to which in later years I was admitted, unless it were that most popular of parts, the part of a listener who appeared intelligent. Equal or perhaps greater was the loss in the fitness or the facility for social life; but how great this was I cannot judge, or how far I showed the defects I have so often heard attributed to those, who have not enjoyed the advantages of public schools and universities."

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[1] Memoirs and Letters of Sir James Paget: Longman, Green & Co., 1901.

Many men, however, have shone in society without any such advantages, and if Paget was deficient in fitness or facility for social life, we think that this must have been due rather to a natural gravity of temperament than to the want of a classical training. As a writer, he was vastly superior to most classical scholars, and, as a speaker, he had few equals in his time. He probably lost little by not going to a public school.

In 1830, he was apprenticed, as was the fashion of that day, to Mr. Charles Costerton, a surgeon in Yarmouth. Of the apprenticeship system, the passing of which old-fashioned practitioners still profess to regret, he has some interesting things to say:

"Many things of great utility in after life could be thoroughly learned; things of which the ignorance is now a hindrance to success; such as dispensing and a practical knowledge of medicines, or the modes of making them; account keeping; the business-like habits needed for practice; care, and neatness, and cleanliness in all minor surgery. Besides, in most cases as in my own, the elements of anatomy could be slowly learned; there was time for reading and for natural history, or any branch of science by which the habit of observing might be gained; and there was ample opportunity for observation in practice without being confused in a crowd of cases in which it is, for a student, equally difficult either to study the whole or to make a good choice."

In this way Paget spent four and a half years, which he thinks was far too long. Not a few patients, especially women, came to be bled. For at that time, he says, there were not a few, especially among the country working people, who deemed bleeding once or twice a year a great safeguard or a help to health. "They came frequently on market days at the times of spring and fall, and generally did their day's work in the surgery. There they were at once bled till they fainted, or felt very faint and became pale; then a pad was put over the wounded vein, and a bandage round the elbow; and they went home, often driving three or four miles into the country. I have no evidence that either good or harm was ever done by this practice."

Paget had inherited from his mother a love of collecting, which took the direction of botany, and, to a less degree, zoology. He studied the botany of the district to such good purpose that he took part with his brother Charles in publishing the *Natural History of Great Yarmouth.* Paget says it would be impossible to over-estimate the influence of his study of botany on the course of his life. It introduced him into the society of studious and observant men; it gave him an ambition for success, or, at the worst, some opportunities for display in subjects that were socially harmless; it encouraged the habit of observing, of really looking at things and learning the value of exact descriptions; it educated him in habits of orderly arrangement. He says, "I can think of none among the reasons of my success—so far as I can judge them—which may not be thought of as due, in some degree, to this part of my apprentice life." He adds, in a phrase that should be pondered by the advocates of a utilitarian education, "The knowledge was useless; the discipline of acquiring it was beyond all price."

While an apprentice, he taught himself French, and translated nearly the whole of Bichat's famous work, "Sur la Vie et la Mort." He also cultivated a family skill in art sufficiently to make sketches of scenery and of some of the simpler objects of natural history and pathological specimens. Some of these, he says, are in the hospital collection: a fungus hæmatodes and an ulcerated cæcum, with which the widow of the patient was so charmed that she begged for a copy of it.

In 1834, Paget entered Saint Bartholomew's Hospital. For the majority of students, and for him at first, work had to be self-determined and self-guided; it was very little helped by either the teachers or the means of study. There was constant dissension and mischievous rivalry among the teachers. The demonstrators had some private pupils, whom they "ground" for the College examinations, but these were only a small portion of the school. The surgeons had apprentices to whom they seldom taught more than to other students. There was a small library stowed away in a room next the operating theatre; books were given out, but there was no reading-room. The students themselves had formed a kind of club in a small room over a baker's shop near the hospital gate, where they could sit during intervals of work, and read the journals, and where some, in the evening, played cards. But there was nothing to encourage any kind of book learning. The dead-house was a miserable shed, damp and dirty, where examinations were made in the roughest and least instructive way, and, unless one of the physicians was present, nothing was carefully looked at, nothing was taught. "Pathology, in any sense of the word, was hardly considered." The museum, on the other hand, was in good order, and well cared for. The lectures varied in quality, those of Lawrence being admirable in their well-collected knowledge, and even more admirable in their order, their perfect clearness of language, and the attractive manner in which they were delivered. The anatomy lectures by Stanley were very elementary, but so frequently repeated that they became fixed in the memory. Paget says: "It was believed that one of my friends, who afterwards became a distinguished comic writer (doubtless Percival Leigh, the "Professor" of *Punch*), passed the College solely by means of the bits of lectures with which he used to make fun by imitating Stanley."

Of the midwifery lectures, Paget says he only attended two. He says that one of his teachers told many stories, some of which were obscene, some very nasty. He adds: "Such stories, I believe, are now never told, and the change is among the many I have watched as significant of a vast increase in the habitual decency, and, I do not doubt, the real morality of students. I may add, the decency of the profession generally; for though it may seem hardly credible, yet I can only too well remember that some of even the most distinguished members of the profession would commonly tell utterly indecent and dirty stories. The vile habit was not theirs alone ; it was prevalent among all of the same or higher social rank ; and, although it had begun to die out, and some kept themselves pure from it, it was pitch, from the defilement of which one feels even now not quite cleansed."

Paget worked hard, and, at the end of his first year, not only came out first in the examination for medicine, surgery, chemistry, and botany, but taught himself German while a student. It was in his first year, too, that he discovered the trichina spiralis. His share in it was the detection of the worm in its capsule. The discovery led to an introduction to Robert Brown. He wished to examine the entozoon with a microscope, and there was none in the hospital. He found the great botanist at work in his little room in the natural history department of the British Museum. He relates that Mr. Children, then chief of the department, in introducing him, said : "Brown, do you know anything about parasitic worms?" The answer was "No, thank God!" But he allowed Paget to look at his specimens with his microscope, and, with the help of it, he made the sketches which illustrated the paper read at the Abernethian Society. Paget never was a dresser, partly because the office cost ten guineas, partly because it seemed to offer scarcely more opportunities of studying surgery than he had had in his apprenticeship.

A house-surgeoncy was far beyond his means. Thus he became disposed for work in the medical rather than in the surgical ward. There was very little active practical teaching in the wards, or by clinical lectures. It was customary, he says, to think it sufficient to give opportunities for learning to those who could learn by looking on, and by occasional rather casual talking about the cases. He says : "Doubtless it was a grave defect ; but it was less then than it would be now, for the great majority of students came to the hospital after apprenticeships, in which, whether in private practice, or in provincial hospitals, they had been learning how to learn and had become familiar with the language, and habits, and apparatus of practice. The result of their study was, I think, to make the average of knowledge among them very nearly equal to that of their successors, equal, *i.e.*, in proportion to the best prevalent knowledge of the time. It may seem that, in this as in many other cases, change cannot be produced in any large class of men unless by so vast a change in the conditions of their mental life as seems utterly disproportionate to its result."

In 1836, Paget became a member of the College of Surgeons. While waiting for an appointment on the staff of his hospital, he took pupils and wrote for the *Medical Gazette*—the predecessor of the *Medical Times and Gazette*—of which he was sub-editor from 1837 to 1842. He also worked with Sir John Forbes on his *Quarterly Review*, and, to the good offices of Forbes, he traces a recommendation to Sir James Clark, which led to his appointment as Surgeon-Extraordinary to Queen Victoria, which he says was conferred on him long before what might have been deemed his time. Besides these journals, Paget wrote for the *Penny Cyclopædia*, and the *Biographical Dictionary*, published by the Society for the Diffusion of Useful Knowledge. During the years 1837 to 1843, he was Curator to the Museum of St. Bartholomew's, and this led to his first office in the school, the Demonstratorship of Morbid Anatomy, to which he was appointed in 1839.

In 1842, he began to make a catalogue of the museum, and he wrote a sketch of a treatise on General Anatomy. In 1841, he was elected surgeon to the Finsbury Dispensary. In 1842, he was appointed Lecturer in Physiology, and, in 1843, a college for the students of St. Bartholomew's was established, of which he was the first warden. From 1843 to 1851, he lived in the hospital. In 1847, he was appointed Professor of Anatomy and Surgery at the College of Surgeons, and assistant surgeon to the hospital. He was now on the high road to success, and, in 1844, he married. In 1851, he was elected a Fellow of the Royal Society. In 1853, appeared his book on Surgical Pathology, which laid the foundation of his fame, and on which it will always rest. It is recognised as a scientific classic, and, when the matter is obsolete, will continue to be read for the soundness of its reasoning and the lucidity of its style. In 1851, he entered seriously on private practice. His success was from the first steadily progressive. Beginning at £70, his income gradually, and, as he says, with one trivial exception, increased till it exceeded £10,000. Then he gave up operating, and it fell at once to £7,000, and then slowly decreased. In some years, he had the most lucrative surgical practice in London. In due course, he became full surgeon to the hospital, and, on his resignation, a baronetcy was conferred upon him. He held all the offices which fall to the lot of the leaders of the profession. He was elected a member of the Council of the College of Surgeons in 1865, and became president in 1865. He was also president of various societies, was a member of the Senate of the University of London in 1860, and Vice-Chancellor of the University in 1883. He was elected a member of the General Medical Council in 1876. He was also an honorary member of several foreign societies, and an honorary graduate of several universities. He had the fullest confidence of the Royal Family, and, at the time of his death, had been for 41 years a member of the household of Queen Victoria, and for 36 a member of that of the Prince of Wales, now King Edward VII. His son says he loved to be in his place at the Court, and to be welcome there, both for his own sake and for his long service. He had all that should accompany old age—honour, love, obedience, troops of friends—among them the most distinguished of his contemporaries. He was supremely happy in his family, whose success he loved to see. He looked forward to death, with the hope of a devout follower of Christ, from the belief in whom he had never swerved, and he died after receiving the last consolation of religion at the hands of his son, the Bishop of Oxford, on December 30, 1899.

The picture of the late Sir James Paget which illustrates this article was specially photographed by THE PRACTITIONER from an oil painting by Sir John Millais, Bart., by kind permission of the Treasurer and Almoners of St. Bartholomew's Hospital. For the reproduction of the autograph we are indebted to Messrs. Longmans, Green & Co.

NOTES FROM FOREIGN JOURNALS.

TREATMENT OF BOIL IN EXTERNAL AUDITORY CANAL.

The following methods of treatment are published in the *Journal Médical de Bruxelles*, and are said to be much in favour in Germany for this painful and oft-recurring affection. First, as regards prophylaxis, these boils usually attack those who, with the object of cleaning it, introduce into the ear various sorts of instruments which are far from satisfying the demands of antisepsis. Frequent syringings of the ear macerate the epithelium of the canal, and produce the same effect.

When once a boil has begun to form, it must not be treated with watery lotions; ointments containing zinc oxide, carbolic acid, or menthol, are much more effective and useful.

℞. Menthol - - - - - gr. iv.
Anaesthesin - - - - gr. x.
Glycerine
Paraffin - - - - āā ℥j. M.

"A strip of gauze is to be soaked in this preparation, and introduced into the external ear."

Boils in a more advanced stage must be treated with applications of alcohol at 90°, or by instillations of absolute alcohol. It is not necessary to be in a hurry to incise the boil, but the core must be made easy of extraction.

TREATMENT OF TYPHOID FEVER.

Stadelmann does not think that any great results have been obtained with serum-treatment; but it is possible, by giving, at the early stage of the disease, two or three doses of 0·20 to 0·30 g. in 24 hours, to procure the elimination of a considerable quantity of infectious germs. In the later stages no curative effect is obtained.

As regards diet, chiefly composed of milk and eggs, the use of gelatin should not be forgotten, as it may be given in the form of either fruit-jellies or meat-jellies. Fats, except cream, must be avoided; sugar must replace the hydrocarbons.

Mineral waters should not be given, as a rule, and alcohol should be looked upon, in this particular instance, as a dangerous narcotic, only to be used in small doses to stimulate the gastric secretion, and as a food. Its antipyretic action is non-existent. Patients, as a rule, show repugnance for alcohol.

The cold-bath treatment cannot nowadays be looked upon simply as an antipyretic, in view of its effect upon the general condition, the heart's tonicity, diuresis and other important functions. The thermometer is not a useful guide for the institution of bath-treatment, which is reduced to two or three baths (86° to 90° F.) in a day, and lasting 10 to 20 minutes. It is to be noted that the temperature curve of enterica has been greatly modified in the last twenty years, and that the fever presents a marked remittent character, without becoming less dangerous.

When baths are contra-indicated, sponging with cold water, or vinegar and water (1 to 4), should be carried out every two or three hours. In alcoholic, and in nervous, patients, baths at 87° to 93° F. lasting 6 to 10 hours, produce a markedly soothing effect.

Bath-treatment is inadmissible in the case of hæmorrhage from the bowels, peritonitis, pericarditis, arterio-sclerosis, etc., and if otitis, or laryngitis, is present, care must be taken that no water gets into the affected organs.

Stadelmann, after many trials, has given up the use of antipyretic drugs in order to control the excited state of the central nervous system, he gives an injection of morphia (gr. $\frac{1}{6}$) at night. Heart-failure calls for injections of camphorated oil, or of salicylate of soda and caffeine. Profuse diarrhœa is controlled by opium enemata; meteorism often yields to salicylate or sub-nitrate of bismuth, or to a cold-pack to the abdomen. In the case of hæmorrhage, an ice-bag must be placed on the abdomen, and all feeding stopped. He has not been well satisfied with the results obtained by injections of gelatin in 2 to 5 per cent. solution, nor with those of adrenalin, 1-in-1,000 solution. Epistaxis must be controlled by plugging the nasal fossæ.

Prognosis in perforation is bad; Stadelmann has never had recourse to surgical intervention.

A water-bed is necessary to guard against bed-sores; if such threaten, treatment by balsam of Peru ointment should be adopted.

In the course of convalescence, meat is only allowed on the 10th day at the earliest, and normal diet not before the 21st day. The patient should rest for from one to two months before returning to work. (*Deutsche med. Wochenschrift.*)

THE USE OF SULPHATE OF MAGNESIUM AS A LOCAL ANÆSTHETIC.

H. Tucker reports his experiences with this salt in relieving pain and allaying inflammation, when applied locally. The application consists of a saturated solution of magnesium sulphate in water; applied on from 15 to 20 thicknesses of ordinary gauze. This is saturated with the solution every half-hour, and is not removed until the end of 24 hours. The parts are then washed with water, and the dressing re-applied, if necessary. The surface is found to be distinctly blanched, but no ill effects result. The nurses, making the application, noticed a partial loss of sensation with tingling of the hands and arms, persisting for 12 to 24 hours. Tucker gives summary notes of several cases, treated with remarkable success, the pain being relieved quickly and the inflammatory conditions subsiding in a short time. His cases include double orchitis following mumps, several cases of gonorrhœal epididymitis, acute rheumatism, gonorrhœal rheumatism, syphilitic orchitis, tubercular peritonitis, facial erysipelas, alcoholic neuritis, traumatic neuritis, sprained ankle, and simple contusions. At his suggestion, the treatment was used by a veterinary surgeon, with complete success, in the leg-injuries of thoroughbred horses. (*Therapeutic Gazette*, April, 1907.)

TREATMENT OF GONORRHŒA, LOCAL AND INTERNAL.

Neisser, in the *Medizin. Klinik*, states that, in spite of the improvements introduced of late in the treatment of blennorrhagia, it is still necessary to prescribe the classical injections of the urethra. Many patients, for various reasons, neglect to follow out regularly the method of injection introduced by Janet, which Neisser applies as soon as possible, using for preference the oxycyanide of mercury in a strength of 1 in 8,000 to 1 in 4,000. Urethral injections yield specially good results, when the patient is not obliged to undertake long marches, but it is well to make sure that the patient carries out his instructions regarding them exactly to the letter, and does not retain the injection in the urethra longer than 10 to 15 minutes, in order to avoid paresis of the sphincter followed by infection of the posterior part of the urethra by the gonococcus. The capacity of the syringe should be 12 to 15 c.c. (ʒiij.–iv.), and the solutions for injection will be composed of, once daily, a 5 per cent. solution in water of antipyrine, containing 3 per cent. of protargol, and, three times a day, of a 3 per cent. solution containing ¼ per cent. of protargol. The fluid is to be retained for 10 to 15 minutes. If these injections produce irritation, they must be changed, because irritation brings about a serous œdema of the mucous membrane, which promotes the growth of gonococci. Astringent injections, or, better still, nitrate of silver 1 in 4,000, will then be ordered. This treatment should be instituted from the first, even in the course of the acute stage, for antipyrine has a marked analgesic effect. The use of balsams internally is also indicated, because these drugs lessen secretion, which has a tendency to increase under the influence of silver salts. Moreover, the balsams, especially gonosan, lessen the irritability of the bladder and urethra; on the other hand, they do not act upon the gonococcus, and cannot therefore constitute the sole treatment of blenorrhagia.

PROPHYLAXIS AND TREATMENT OF PERITONEAL INFECTION BY NUCLEINATE OF SODIUM.

Professor Chantemesse read, at the *Académie de Médecine*, a note on the results obtained by himself and M. Kahn in the treatment of intestinal perforation in typhoid fever. Spontaneous cure is an extremely rare event, and surgical intervention yields very little success. The hypodermic injection of nucleinate of sodium increases hyperleucocytosis and also the resistance of the patient. Its action is analogous to that of collargol, but is far more energetic. Hypodermic injection is, in man, the best method of administration. A sterile injection of 40 c.c. of normal saline, containing dissolved in it 40 c.g. of nucleinate of sodium, made in one or two convenient places, the flanks or the outer surface of the thighs, causes in a few hours some local pain, which can be allayed by the application of opium fomentations. After twenty-four hours, a slight amount of swelling and redness appears, but has disappeared by the following day. Two or three days later, a second injection is given, and a third later on, the dose being diminished in each instance. There is, in this way, kept up a hyperleucocytosis favourable to the fight undertaken. Nucleinate of sodium appears to act by a quick and somewhat lasting increase in the function of phagocytosis. Its mode of action is powerful, and must be proportioned to the nature of the case. The increase in the leucocytes is chiefly in the mono-nuclear type, and is found in six to eight hours after injection. It continues to increase for about forty-eight hours, and lasts for four or five days, decreasing slowly. Chantemesse determined the opsonic index to be 1·60 before, and 2·50, twenty-four hours after the injection of nucleinate of sodium, in the case of a man suffering from perforation. Clinically, the following facts were noted. In typhoid patients, who, after hæmorrhage from the bowel, complained of sharp pains in the abdomen, with retraction and rigidity of the abdominal walls, and loss of hepatic dulness, an injection of nucleinate, made as soon as possible after the first appearance of the pains, brought about, at the end of twenty-four hours, the complete, or almost complete, cessation of the pains. On the next day, the abdomen was still tympanitic, but less painful and allowing palpation, which gave to the palpating hand the feeling of loops of bowel tumefied and motionless, similar to what is felt in some cases of tubercular peritonitis. By degrees, and especially if the injection was repeated in two or three days, the abdomen became more supple, and the hepatic dulness regained its normal area. At the same time, the general condition of the patient was good, the temperature, after a slight rise three or four hours after the injection, fell towards normal, the pulse came down, and, by degrees, complete recovery was obtained. It is, of course, impossible to say that a perforation was actually present in these cases, but the extreme probability, that such was the case, is supported by the post-mortem evidence of two cases of large perforations in which injections had been given, and operation, though urged, was refused. All the classical symptoms of peritonitis, due to perforation, were present, but injections were not given until fifteen to eighteen hours after the first sign of perforation. Twenty-four hours later, there was general improvement in every direction, and an operation could have been attempted with success. The patients lived for twelve days. In the peritoneum, was found a well-organised system of defence by means of leucocytes and adhesions, while the perforations themselves, in spite of their large size, were pretty nearly obliterated by omentum and organised connected tissue. An injection of nucleinate, given as soon as the earliest symptom of a perforation is noted, will have a few hours' start of the inevitable peritonitis, and thus will be able to bring the peritoneum into a better state of defence against the onset of its inflammatory foe. The hyperleucocytosis induced is particularly useful for the prevention, or modification, of a peritonitis, and, even if it does not cure, it increases the chances of success in the subsequent surgical procedure.—(*Revue de Thérapeutique.*)

ETHYL IODIDE IN WHOOPING COUGH.

Amat, at a meeting of the *Société de Thérapeutique*, called attention to the communication on this subject which he made in 1902. He has found all other methods a failure, and again recommends the inhalation of the vapour of this compound at the beginning of the coughing fits. These decrease from 35 to 6 in the day, and become much less violent. The bronchial secretion becomes more fluid, and the disease is cut short in three days. He has also been able to confirm the effects of re-vaccination upon the number and force of the coughing fits; the improvement taking place when the pustule appears. How this is effected is as yet unanswered. Is it a case of *febris accedens, spasmos solvit?* Amat does not know. He reports the fact, and invites other practitioners to go and do likewise.—(*Le Progrès Médical.*)

THE USE OF SUGAR IN LABOUR

G. Keins, in the *Revue pratique de gynécologie, d'obstétrique et de pédiatrie*, calls attention to the value of sugar in increasing the energy of the uterine contractions in labour. He is in the habit of ordering 25 grammes (about five lumps) in a quarter of a glassful of water, making a concentrated solution. This dose can be repeated once or twice at half-hourly intervals. It not only produces an increase in the strength and frequency of the contractions, but also acts upon the rest of the muscles by stimulation. It becomes an oxytoxic and a real tonic, which raises the muscular force of the patient, and hastens the expulsion of the fœtus. In induced labour, sugar can be an useful assistant to the mechanical means employed. Keins prescribes, from the beginning of induction, two or three doses of 25 grammes. It must be given as soon as possible, because, in labour before term, the uterine muscles are not in the physiological condition of labour at term. Labour takes place more quickly, and the patient is less exhausted.

A NEW SALT OF MERCURY.

At a recent meeting of the *Société de Thérapeutique*, Dalimier gave a short description of a new mercurial salt, mercuric bromide ($HgBr_2$), which contains a large amount of mercury. As it is not very soluble in water, Dalimier adds another salt to it, bromide of sodium, which increases its solubility. His formula is made up thus:—

Bromide of mercury - - - -	1·08 g.
Bromide of sodium - - - -	1·04 g.
Sterilised water - - - -	100 c.c.

1 c.c. of this solution contains 1 c.g. of mercury, and the preparation being easy to manage, allows the introduction into the system of a definite fixed dose of the active metallic ingredient. The solution is neutral in reaction, is easily absorbed, and can be sterilised at 120° C., being very stable, a quality which no other solution of mercury possesses. When a dose of 1 or 2 c.c. (0·01 or 0·02 of Hg.) is injected into the muscles of the buttock, no pain is caused, though the dose of 2 c.c. gives rise to a slight momentary smarting of little intensity. Small nodes, scarcely perceptible, result, but never the indurated patches observed after injections of biniodide. The solution is equal to all others in activity, and superior to them, by reason of the little pain it produces. According to Leredde, the tolerance for this salt is very much greater than for any others (benzoate, biniodide and perchloride). It has one disadvantage; a platinum-iridium needle must be used, because it acts very quickly upon steel.

TREATMENT OF STYE.

Sabouraud commends the use of an old-fashioned remedy, the *Lapis divinus*, for this troublesome affection. Lapis divinus is composed of equal parts of sulphate of copper, nitrate of potash, and alum, with the addition of camphor in the proportion of one-fiftieth of the whole. These are fused together, and run into sticks. For use with styes, a lotion is made by dissolving 1 of lapis divinus in 200 of rose-water. The treatment consists of epilation of every lash showing a stye, or even a simple red point at its base. The patient is then told to bathe the lids, 10, 20, or 30 times a day, with the lotion. In a few days the eruption of styes will have ceased, but, should another appear, the affected lash must be epilated, and the bathing of the lids persevered with religiously. The patient must be assured that the lashes will grow again, but it will be a month before this assurance will become a material fact.—(*La Clinique.*)

Reviews of Books.

The Treatment of Diseases of the Digestive System. By ROBERT SAUNDBY, M.D., M.Sc., LL.D., F.R.C.P.; Professor of Medicine in the University of Birmingham; Senior Physician to the General Hospital; Consulting Physician to the Eye Hospital, and to the West Bromwich Hospital London: Charles Griffin & Co., Ltd.

FEW disorders are so common as those of the digestive system, yet few receive such scanty teaching in most hospitals. Dr. Saundby's book is written, to serve as a guide to treatment. The first chapter is useful, as it gives the various methods of investigation of the contents of the alimentary canal, and adds an inexpensive list of apparatus for such examination.

The remaining chapters deal with the diseases, symptoms, and differential diagnosis, in a clear and concise manner, and the volume is rendered complete by various formulæ and a useful index.

Functional Nervous Disorders in Childhood. By LEONARD G. GUTHRIE, M.A., M.D., F.R.C.P., Senior Physician to Paddington Green Children's Hospital. Pp. 300. London: Oxford University Press. 5s. net.

WE have read no book upon this subject which can compare with Dr. Guthrie's work for charm of literary style, and comprehensiveness of survey. This book is so fascinating that one must needs choose some time of leisure for its perusal, for, when once opened, it is not easily laid aside. It is full of quotation and anecdote from writers of all ages, from Tertullian to Calverley, and from the Book of Samuel to "the Fairchild Family." It is to be hoped that it will be read by many (we might say multitudes, and there would still be many left) of the faddists of to-day, who have so much to say on the proper methods of educating and up-bringing children. It deals with many important questions of education, the place of corporal punishment in the training of the young, the hours of study, the effect of fear in preventing progress at school, and many other matters of great practical importance to those concerned in teaching. Infant murderers figure here, and there is full description of infant prodigies of learning, and the youthful devotee of my lady nicotine might be saved from his awful career, if he could but read the gentle suasion of common sense, which appears everywhere mingled with the kindly humour of Dr. Guthrie's work, and in particular in the section on the evils of tobacco. On this matter as, on the use of alcohol, Dr. Guthrie protests, as he does in many other matters, against the exaggerated and misleading statements, which are too often made, and made, as he points out, with considerable detriment to the young and impressionable minds which receive them.

But it must not be imagined that the work is merely a literary recreation, it is a scientific work of high value, and useful descriptions of treatment will be found here as well as discussions on points of pathology and ætiology. We think Dr. Guthrie's work is likely to take its place as a standard work on the subject, and to be one of the most popular of the Oxford medical publications.

The Treatment of Disease in Children. By G. A. SUTHERLAND, M.D., F.R.C.P., Physician to Paddington Green Children's Hospital, etc. Pp. 311. London: Oxford University Press. 5s. net.

THE publishers of the new series of handbooks, the Oxford Medical Manuals, are to be congratulated on their enterprise, which is likely to be received with warm appreciation by the medical reading public. The present volume by Dr. Sutherland is a good example of the series, and deals with the treatment of disease in childhood in a very helpful and practical way. As the preface explains, this book describes the practice of one, based on the teaching of many, so that the author does not aim at mentioning all the possible methods of treatment, but mainly those which he has himself found most valuable. In the few references, which he makes, to authorities, he is sometimes inaccurate, but, apart from this, the work is admirable. In many ways, the book is made the more interesting by the fact that it represents the author's own experience; his summary of the results of laparotomy in tuberculous peritonitis, for instance, is at once pithy and personal; "as regards the results of laparatomy, in ordinary uncomplicated cases, I have seen no changes follow, which cannot be seen under medical treatment, save perhaps the formation of a tuberculous sinus." The chapter, which deals with infant feeding, is terse, and deals chiefly with main principles. The milk, he says, should be from a clean dairy farm; excellent advice! It almost reminds one of Oliver Wendell Holmes' advice to the would-be centenarian, "the first thing is to select a couple of long-lived parents"; we should like to know the address of that farm. Dr. Sutherland says that, in pneumonia, he would avoid cold applications to the chest, such as the icebag; he discusses fully the treatment of pneumonia, and this chapter is a good example of the practical advice which characterises this volume throughout, and makes it one which we feel sure will be widely appreciated.

A Manual of Diseases of the Eye. By CHARLES H. MAY, M.D., Ophthalmic Surgeon to the City Hospitals, New York, and CLAUD WORTH, F.R.C.S., Ophthalmic Surgeon to the West Ham and East London Hospital; Assistant Surgeon to the Royal London Ophthalmic Hospital, Moorfields. Pp. 400. London: Baillière, Tindall & Cox. 10s. 6d. net.

SINCE 1900, four editions of May's *Manual of Diseases of the Eye* have been published. In the present work, Dr. May has had the advantage of the co-operation of an English ophthalmic surgeon. This book has been especially written for senior medical students and general practitioners, and to these we can confidently recommend it. There are over 300 illustrations, which include 20 coloured plates, illustrating the commoner changes which occur in the fundus of the eye in disease; these are all excellent, and form a very useful ophthalmoscopic atlas.

Text Book on Diseases of the Heart. By GRAHAM STEEL, M.D., F.R.C.P., Senior Physician to the Manchester Royal Infirmary. With an Appendix on *The Volume of Blood in relation to Heart Disease.* By J. LORRIAN SMITH, M.A., M.D., Professor of Pathology. Pp. 389, illustrated. Manchester: Sherratt & Hughes.

THIS is a very readable and up-to-date little book. Though we should like to have seen a more complete preliminary table of contents for the purpose of reference. The fifty odd pages devoted to "Physical Methods of Diagnosis" are excellent. The changes in the general musculature of the heart, and also in that of the orifices, are very fully treated, but the statement, on page 52, that "no mitral valves are competent without the assistance of the heart muscle" is surely too absolute. Those of us, who have done much post-mortem work, will be able to recall numbers of cases, in which, on forcibly distending a flaccid left ventricle by means of water pressure, the mitral valves would not allow a drop to pass. On page 67, we should like to see mentioned that re-duplication of the first sound is not uncommon in perfect health. A little more space devoted to the discussion of the action of drugs would, we think, have been advisable. The chapters on diet are very good, especially when the influence of carbohydrate food is discussed. For the average chronic cardiac case, however, we should not recommend the total exclusion of "potatoes, bread, and farinaceous puddings," at lunch and dinner, although it is very useful to do so in special cases.

We are glad to see a criticism of advocates of the "Nauheim System" with reference to their placing too much reliance on the percussion of the heart area, and we quite agree with the author, when he says that it is a method "peculiarly open to fallacy."

It would have been better, we think, to have excluded the names of other writers *entirely*, and not in the partial way in which it has been done. A short account of the details of the methods, used for the taking of cardiac and pulse tracings, would have added to the value of the book. On the whole, the work is well and clearly written, and is well worth reading.

Rational Organotherapy with reference to Urosemiology. By Prof. Dr. A. VON POEHL, Prof. DR. PRINCE, I. VON TARCHENOFF, Dr. ALF. VON POEHL, DR. P. WACHS. (Translated from the Russian Text), Vol. I. Med. 8vo, pp. 239. London: J. & A. Churchill. 7s. 6d.

THE name given to this volume will encourage the reader to expect a discussion, on traditional lines, of what has been described as "substitutional organotherapy," *i.e.*, organotherapy, which seeks to supply to the system those secretions, which, on account of atrophy or disorder of the tissues from which they normally arise, are no longer at the service of the body economy.

The reader will, however, be surprised to find that the writers of this volume have pursued quite a different theme. They seek to show that it is possible, to derive, by various chemical processes, a more or less complex crystalline body which, in the words of Kobhut (1906), "appears to be closely allied to diethylenediamine or peperazine," this body, originally discovered by von Böttcher in old anatomical spirit specimens, is well known as "spermine." It is the object of Professor von Poehl and his collaborators to show English-speaking practitioners, through an anonymous translator, that spermine has a wide range of applicability in disease, not as a means of replacing this or that defect of organ or tissue, but as a means of increasing "tissue respiration" and oxidation in such widely different disorders as tuberculosis, miscarriages, diabetes mellitus, neurasthenia, chorea, tabes dorsalis, diseases of the heart, lungs, kidneys, intoxication with chloroform, and infections; such as those of syphilis and Asiatic cholera. Whatever may be the cause of these maladies, there is something common to them all, which may be ascribed to defective oxidation. Spermine or rather Spermine Poehl is a katalysator in the sense of the word as introduced by Ostwald, *i.e.*, it is a ferment which is capable of accelerating such processes as oxidation, which, by means of many disorders, has fallen into desuetude. In a sense, Spermine Poehl is a suitable "elixir vitæ," which, by various chemical processes, can be extracted from the testicle, ovary, leucocytes, and various other tissues and organs.

It is quite impossible, for want of space, to criticise the specious arguments advanced by the writers to advance their speculations, which are fully set out in 215 pages of closely-printed matter, in which figure the names of a large number of investigators, whose names are household words to the medical world. The whole field of physiological and pathological inquiry has been ransacked to find support for the theories of the book, which is little less than an apotheosis of Spermine-Poehl. Judging from the polemical style of the writers, it will fare badly with any critic or rival firm of manufacturers of Spermine, who presume to question their deductions, for whether they agree or disagree with any one or all of the speculative deductions of these authors, they may rest assured that their names and their writings will be made use of to swell the number of 569 references at the end of the book.

It is our duty to peruse the book, and communicate to our readers the impressions we have been able to derive from it. We never had an easier task, and do not hesitate to say that, despite the plausible arguments advanced, despite the possession by the writers of a wide aquaintance with the literature dealing with the authors' subjects, which they consider germane to their subject, and despite the vigorous personality of one of the writers, who has extolled the virtues of Spermine-Poehl the length and breadth of Europe, we are not convinced of the rationalism which is so boastfully advertised in the title of this book and its contents.

Clinical Diagnosis and Urinanalysis: A Manual for Students and Practitioners. By James Rae Arneill, A.B., M.D., Professor of Medicine and Clinical Medicine in the University of Colorado, etc. Medical Epitome Series, edited by V. C. Pedersen, A.M., M.D. London: Hodder & Stoughton.

This little book seems to give an excellent account of the methods of blood examination, examination of the stomach contents, of the fæces, of the sputum, and of the urine. Both microscopical and chemical methods are described, and also the appearances of morbid elements, etc. The book is well illustrated, and should prove of great service to the busy practitioner.

Midwifery for Nurses. By Henry Russell Andrews, M.D., B.S. (Lond.), M.R.C.P. (Lond.), Assistant Obstetric Physician, to and Lecturer to Pupil-Midwives at, the London Hospital; Examiner to the Central Midwives' Board. Pp. xi + 308. 79 illustrations. London: Edward Arnold.

We congratulate Dr. Andrews on his book. The subject is dealt with clearly, concisely, and without ambiguity. The teaching is necessarily dogmatic, for that is really the best, in fact the only, line to adopt when those for whom it is intended are taking up the subject with a strictly utilitarian object in view. The book comprises the lectures which Dr. Andrews delivers to pupil-midwives, and we have no hesitation in saying that these pupils, given average intelligence, should certainly prove to be thoroughly sound, competent, and trustworthy midwives, possessing a good practical knowledge of their work, and, what perhaps is quite as valuable, a due and full appreciation of its limitations so far as they themselves are concerned.

The Operative Treatment of Prolapse and Retroversion of the Uterus. By J. Inglis Parsons, M.D., M.R.C.P., Physician to the Chelsea Hospital for Women. London: John Bale, Sons & Danielsson, Ltd. 3s. 6d. net.

This book does not pretend to be a compendium of all that has been done and attempted by others for Prolapse and Retroversion, but only what, after twenty years' work on the staff of a special hospital for women, the author has found by experience to produce the best results.

It is essentially an exposition of the author's experience, and contains a full and detailed description of the operation of injection of the broad ligament for prolapse devised by himself, with the results of its application in 105 cases, which include all the cases operated on by him to the end of the year 1905.

These results, which seem to be surprisingly good, are presented in tabular form. All the patients were much improved. In 75 per cent., the uterus kept up permanently. In 20 per cent., the uterus was kept within the vagina instead of being outside, but was lower than normal. In 5 per cent., the prolapse recurred.

"In considering these results," says Dr. Parsons, "we must remember that a large proportion of these cases had procidentia for 10, 15, and even 20 years before the treatment was applied. Many of them had been the round of the hospitals without any benefit."

Dr. Parsons takes no extreme views on that vexed question the use of pessaries, and he states the timely warning that "in order to be successful, the practitioner must realise that there are great differences in the shape, size, and tone of the vagina and perineum. The pessary, which will suit one woman, is utterly useless in another. Further than this, the pessary which, at first, is most suitable for keeping the uterus in position may be unsuitable after the vagina and uterine ligaments have recovered their tone."

The thoughtful practitioner cannot fail to be interested in the perusal of this small brochure.

The Animal Parasites of Man: A Handbook for Students and Medical Men. By Dr. MAX BRAUN, Professor of Zoology and Comparative Anatomy, and Director of the Zoological Museum of the University of Königsberg, Prussia. Third enlarged and improved edition. Translated from the German by PAULINE FALCKE. Brought up to date by LOUIS W. SAMBON, M.D. (Naples), Lecturer at the London School of Tropical Medicine, and FRED. V. THEOBALDS, M.A., Vice-Principal and Economic Zoologist to the South-Eastern Agricultural College. Pp. xix and 453. London: John Bale, Sons & Danielsson. 21s. net.

BRAUN'S work on parasites is well known in the original, and we are glad to welcome it in its translated form. The translation seems to have been well done save for an occasional clumsy expression (*e.g.*, lung "cavern," p. 37), which should have been improved by the medical editor. On the whole the work is well up to date. We miss, however, any reference to Schaudinn's work on the *amœba coli*, and Loos's observations on the development and mode of transference from the skin of *ankylostoma* were surely published before the present translation was printed. The book is profusely illustrated, and we can cordially recommend it.

Chemistry of the Proteids. By GUSTAV MANN, M.D. (Edin.), B.Sc. (Oxon), University Demonstrator of Physiology, Oxford. Pp. 606. London: Macmillan & Co., Ltd. 15s. net.

THIS book is based on Professor Otto Cohnheim's "*Chemie der Eiweisskörper.* The subject matter, however, has been brought up to date, and very fully extended, but many of the views, expressed by Dr. Gustav Mann, are somewhat at variance with those held by Professor Cohnheim. Special stress has been laid upon some of the more important subjects dealt with, subjects such as cellular metabolism, nitrogen-radicals of the albumin molecule, the synthesis of proteids as described by Curtius and Fischer, the bearing of physical chemistry on the phenomena of precipitation, and the passing into solution of albuminous compounds. The study of the auto-digestion of the nucleo-proteids has received special attention. In the important chapter upon the blood, Dr. Gustav Mann has had the valuable help of Dr. John Haldane, F.R.S. The book is excellent, and the large number of references, placed at the foot of each page, very considerably enhance its value as a standard work. We can confidently recommend it to all those workers, who are engaged in teaching, or research in chemical physiology.

The Diseases of the Nose and its Accessory Sinuses. By H. LAMBERT LACK, M.D. (Lond.), F.R.C.S. Pp. 414; 124 illustrations. London: Longmans, Green & Co. 25s.

THIS handsome volume is indicative of the marked progress recently made in the study and treatment of nasal diseases. It is sure to invite attention, and in many points will attract criticism. The scheme of the book is well planned, and the result in many chapters is very satisfactory. Those sections dealin with affections, on which Dr. Lack writes freely from his own personal investigations, such as those on nasal polypus and fibrinous rhinitis, surpass others, in which he does not appear to be so personally interested. Thus the submucous resection of the septum is inadequately described, while the description of Killian's operation on the frontal sinus would hardly meet with the approval of its author.

Very few trifling misprints are noticed, the name of Kiaer is given as Kicer (16), and Panzer's scissors are attributed to Panza (p. 147). "Colds" are still stated to be "most often due to some climatic influence." The chapters, dealing with nasal polypi and deformities of the hard palate are very well written, and bear the stamp of the author's personal views; but possibly these are advanced too strongly for a text-book.

Although in one part, Dr. Lack readily insists on the importance of respecting the integrity of the inferior turbinal, one is surprised to find that, when all other treatments fail in hay fever, he does not hesitate to extirpate the inferior turbinal or middle turbinal, or even both. In the present uncertain pathology of hay fever, it seems somewhat dangerous to advance this treatment in a text-book.

The illustrations throughout are most artistic and excellent, and the volume is certain to excite great interest amongst specialists.

Practical Sanitary Science. By DAVID SOMMERVILLE, M.D., M.R.C.P., D.P.H., Lecturer in Public Health, King's College, London. Pp. X. + 310; illustrations 92. London: Baillière, Tindall and Cox. 10s. 6d. net.

DR. SOMMERVILLE has had much experience in the teaching of Public Health Students, and this book is a summary of the series of demonstrations, which he has given from time to time in the chemical laboratory. It is, therefore, chiefly intended as a guide to, and for use during, practical work; and for this purpose, we can confidently recommend it. The various processes required in the chemical examination of water, foods, air, soil, sewage, etc., are set forth clearly and concisely, and there is an excellent chapter on disinfectants, which should serve as a useful introduction to work in this subject, the practical study of which is apt to prove difficult and confusing to the ordinary Public Health Student. Another good feature of the book is the Appendix, which gives in small compass, the chemistry which the student most requires to know for Public Health examinations.

We do not, however, think that the brief chapter on the bacteriological examination of water can be of any possible use, and we would suggest to the author that he should leave it out altogether in the next edition. This subject is too large to receive anything like adequate treatment in a work of this kind, which, as already pointed out, is intended for the chemical laboratory, and need not, therefore, concern itself with practical work in Bacteriology.

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Notes by the Way.

Death of Sir William Broadbent, Bart.

It is a matter of very sincere regret to us to have to record the death of Sir William Broadbent, K.C.V.O., Physician in Ordinary to His Majesty King Edward VII. and to H.R.H. the Prince of Wales, and formerly Physician Extraordinary to Her late Majesty Queen Victoria. In the autumn of last year, Sir William had an attack of influenza, which was accompanied with pneumonia, but from which, under skilled treatment, he perfectly recovered. A second attack, however, followed by endocarditis, proved fatal, and his death on July 10 caused a gap in the foremost rank of the profession which will not be easily filled. It is quite impossible to do justice to the memory of so distinguished a man in the space at our immediate disposal, and at present we must content ourselves with a passing tribute to his work. At the early age of 24, he obtained the degree of Doctor of Medicine from the London University, and subsequently the Universities of Edinburgh, St. Andrews, Leeds, McGill, and Toronto honoured themselves by conferring upon him their Doctor's Degree *honoris causa*. He was also a Fellow of the Royal Society. As a teacher and consultant, he was distinguished for the extreme care with which he investigated every case submitted to him, and he never allowed the most minute detail to escape his notice.

Diseases of the nervous system claimed his careful attention, and his Lumleian Lectures on Structural Diseases of the Heart established his reputation as an authority on heart disease, and, in later years, his interest in the movement for the prevention of tuberculosis, and the establishment of sanatoria for consumptive patients contributed largely to its success.

All good and philanthropic work enlisted his deepest sympathy and active co-operation, and his liberality was both unostentatious and widespread. His contributions to medical literature were numerous and valuable.

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Multiple Personality.

A RECENTLY issued pamphlet, reprinted from the proceedings of the Society for Psychical Research, recalls that exceedingly interesting little book, entitled *The Strange Case of Dr. Jekyll* *and Mr. Hyde.* Most of our readers will doubtless still have in their recollection that story of dual personality, which was as remarkable for its ethical teaching, as for the weirdness of its conception, and which could hardly fail to raise in their minds the suspicion that there might be the question of an *alter Ego* confronting every thoughtful mind. But the case of multiple personality, to the extent of ten distinct characters, to which Dr. Albert Wilson has drawn attention, is not a little staggering. At the same time, the evidence that such a sequel to an attack of influenza is possible is too well authenticated to be lightly put aside. The history of the case, in certain details, is on all fours with others which have been less minutely recorded, and goes to show that, by some unknown process, a conscious state of existence utterly unlike its immediate predecessor may be "switched on," that a state of absolute babyhood may take the place of fairly developed adult intelligence, and *vice versâ,* that in the various stages of existence, there may be styles of caligraphy utterly dissimilar, to the extent even of writing from right to left instead of from left to right, that ability to draw from memory in a state of total blindness may be manifest, when in a previous stage of sighted existence such a power is absolutely wanting, and that, ultimately, an abnormal state may take the place of the normal.

Dr. Wilson's hypothesis that each of the sub-stages, that is the abnormal, is as much an individual or character as the normal, each of them being merely a fraction of the complete personality or Ego, suggests that a new light is thrown on the mechanism of the brain, and its relation to mind and personality. To use his own words, it "assumes that the pyramidal layer of the brain may be divided as a whole, or in part, into districts," and that these "districts may be supposed to correspond to different personalities."

It is quite possible that the influence of an occult form of disease upon the functions of the brain, as here observed, may throw additional light on the effects of heredity and environment upon the individual, and be helpful in determining the principles on which future legislation, social and educational, should be based. On this point, Dr. Wilson says:—

"If we go among the masses, we find adverse circumstances working terrible havoc among the children, such as bad air, malnutrition, sickness from improper exposure, brain attacks or meningitis, fits, and, above all, bad heredity due to drunken parents. The children that survive are liable to become abnormal, even degenerate and criminal. But we cannot regard them as fully responsible for their actions and tendencies. We have to remember that they have never had a fair chance of developing their normal personality, or their highest Ego. Circumstances, over which they have no control, have switched them on to a wrong path physically at the beginning of their lives, and prevented them from acquiring the self-control of the properly civilised man."

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The Poor Consumptive.

Professor Osler recently called attention to the problem of the consumptive poor as being all-important in the question of dealing with the scourge of tuberculosis. Every practitioner with experience of crowded urban districts knows to his cost the extreme difficulty of dealing with this class of case. All the available institutions are flooded with applications, and suitable cases have to wait three months or more for a vacancy. The matter, or, at all events, this particular part of it, really seems to be too big for individual effort, and suggests that the solution will inevitably be obtained by bringing tuberculosis into line with other notifiable diseases, for which hospitals are provided and maintained out of the rates. It is obviously a matter for collective, rather than individual, effort. In order that this may be carried out efficiently and effectually, compulsory measures will be necessary.

It would be a most interesting topic for philosophical inquiry as to what extent, directly and indirectly, the medical profession is responsible for the socialistic—perhaps, for fear of raising needless alarm, it will be wiser to say collectivist—trend of ideas in local government. There are already material evidences that this tendency has borne much fruit, for they are writ large throughout the length and breadth of the land in the shape of fever hospitals, asylums, and public health measures of all sorts, many of which very considerably limit the freedom of individual action. Is there anyone bold enough to maintain that the end has not justified the means? Can we say that finality in these matters is even yet in sight? The intellectual descendants of Cnut's courtiers may place the chair of the

State on the shore, and urge that the further advance of the tide may be stemmed, but they will have as much success as their much-esteemed relative, the famous Mrs. Partington, obtained with her mop. The value of collective effort is far too well and too widely appreciated, nowadays, for it to be cribb'd, cabin'd, and confin'd even within its present bounds, far-reaching as these may appear to be.

As pioneers in, and instigators of, this beneficent work, the medical profession is justly entitled to claim, for its calling, the honour of being the only perfectly altruistic society extant. No other profession labours so industriously, and so unremittingly, to "cut its own throat"; and assuredly, in this matter, virtue has been its own (and only) reward. Infectious cases are rigorously isolated, the cause of infection is hunted down and destroyed whenever and wherever possible, the why and wherefore of almost every particular in connection with disease, and its prevention and treatment, are explained, more or less lucidly, and certainly with bewildering frequency and prolixity, in the columns of the lay press. Everything, in fact, is done to point out how best to avoid coming into the hands of the doctor. Can altruism further go ?

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Physical Deterioration.

THE subject of physical deterioration has been revived at Exeter, and apparently it has been assumed that, in spite of the findings of the recent Committee on the subject, the alleged degeneration of the nation is a proven fact. In this connection, the *Westminster Gazette* recalls very appositely *Mr. Punch's* famous jest, declaring that whenever it hears it said "John Bull isn't as strong as he used to be," it replies, "He never was." There is much point as well as wit in this, for, while acknowledging freely and fully that there is much, lamentably much, requiring radical alteration in the condition of life among the poorest classes, rural as well as urban, there are no real grounds for establishing a scare on the subject. The real evil is one against which successful action could be greatly promoted by the help of an united profession. "Back to the land," under properly adjusted conditions, say by way of small holdings and reafforestation, seems to be one possible solution, and it is one that appeals to the self-interest of the profession. One certain result would be large families of healthy children, yielding us again the sturdy stock indispensable for our national and imperial needs and requirements.

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The Alcohol Question.

Sir James Crichton-Browne's informal little census, and his remarks thereon, have raised a storm in a tea-cup, although he was merely voicing the opinion of the greater portion of the profession on the use of alcoholic beverages. It cannot be denied that this opinion has a purely empirical basis, but the same is the case with one or two other things of great value in medicine, notably the administration of mercury in syphilis. Certainly, so far as they go, laboratory experiments seem to be against the opinion, but the question is one in which practical clinical experience counts, and rightly counts, for very much more than the very limited powers of observation by research into the still unknown mysteries of metabolism. There are, moreover, one or two points of difference between the two methods, which are often, if not invariably, lost sight of. In the alcoholic beverages in common use, the alcohol is in weak solution, is only one among other constituents, and, to an extent depending upon the age of the liquor, has been partly converted into ethers. Laboratory experiments are usually made with a solution of pure alcohol. Again, there is all the difference in the world between the internal economy of a human being and that of a test-tube.

If the use of alcoholic beverages is really fraught with the dangers attributed to it by extremists, the surprising part of the matter is that the accommodation in our gaols and asylums does not demand an immense increase. As a matter of fact, it is more than probable that the greater proportion of the present inmates of these institutions would have arrived at the same destination sooner or later, if they had never known or tasted anything stronger than water.

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Storage of Water.

It is universally admitted that most wines and spirits improve in value and in quality by being kept, and we have it on the highest authority that "the old is better." Now there is also impressed upon us the fact that, from a hygienic point of view, water is rendered more wholesome by being stored in reservoirs. In his recent report to the Metropolitan Water Board, Dr. Houston stated that there was a consensus of opinion among bacteriologists that pathogenic microbes did not multiply in storage reservoirs, but gradually lost their vitality. There was a divided opinion as to how long a time was sufficient to effect their destruction, but the essential point was that each day's storage made for safety, and that a period was reached when all the pathogenic bacteria had perished, and that filtration alone was necessary to improve the chemical and physical qualities of the water. Indirect and inferential proofs had led epidemiologists and bacteriologists to regard storage as of paramount importance, and, until the safety limit, doubtless a variable quantity, had been determined, it was obviously desirable to store water for as long a time as was economically possible. As it is the practice, in many country districts, for the inhabitants to draw their household supply of water from the nearest running stream, the importance of storing and filtering such water should be widely known.

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Practical Notes.

The Colourless Blood Corpuscles.—Not so very many years ago, there were but two types of blood corpuscles recognised in the human blood, namely, the red or coloured non-nucleated blood corpuscles, and the white or colourless nucleated blood corpuscles. In health, the proportion of colourless corpuscles is only 1 to about 500 coloured corpuscles. During the last few years, much attention has been paid to the blood, both in health and in disease, and various observers have classified the types of colourless corpuscles which exist in the blood. There are many forms of leucocytes in the mammalian organism, and these various forms possess different attributes, and certainly act very differently in the reaction to injury, or the *process of inflammation.* These leucocytes, when at rest, are nearly spherical masses of granular protoplasm. In all cases, one or more nuclei exist in each corpuscle, and many of these cells exhibit amœboid movement. The average diameter of the leucocytes is $\frac{1}{2500}$ of an inch. So long ago as 1846, Wharton Jones drew a distinction between the *finely and coarsely granular cells* and the *non-granular "nucleated" cells.* Between 1878 and 1887, Ehrlich, in a series of papers, showed that the various kinds of granules in the leucocytes behaved differently to the aniline dyes, and he pointed out that these granules were by no means fatty, but were rather of the nature of a glandular excretion. More recently, Kanthack and Hardy have materially advanced our knowledge of the various types of leucocytes, and the following classification will be found to be a useful one to remember:—

1. *The Polymorpho-nuclear Cells.*—These contain several nuclei united by very fine threads of chromatin. Their protoplasm is filled with *fine* granules, which stain readily with acid dyes like eosin, hence they are known as finely granular oxyphil cells. These were styled by Ehrlich "neutrophils," as he thought that the granules were stained with neutral dyes only, but Kanthack and Hardy have proved that Ehrlich's neutral stain must be considered as a weak acid dye. The polymorpho-nuclear cells are perhaps the most important of the leucocytes, constituting, as they do, about 70 per cent. of the total. It is the polymorpho-nuclear cells which are most actively amœboid, and this gives them the power of ingesting

foreign particles, and also the power of digesting bacilli (phagocytosis). Metchnikoff has applied the term *microphage* to this type of cell.

2. *The Eosinophil Cells, or the coarsely granular Oxyphil Cells.*—The nucleus is usually simple and well defined, but it may be somewhat irregular. The granules in the protoplasm are *large* and *coarse,* and they are deeply stained by acid aniline dyes, such as eosin. In the human blood, they comprise only about 5 per cent. of the total leucocytes, although they are more numerous in the blood of the horse. These cells are not so actively amœboid as the polymorpho-nuclear cells, and are said to be rarely phagocytic.

3. *The "Mono-nuclear" leucocytes* have fine granules in their protoplasm, which stain readily with basic dyes ; hence they are spoken of as finely granular basophil cells.

4. *The coarsely granular Basophil Cells.*—These are large cells, which are found in the connective tissue in the animal kingdom from the frog upwards, and are known as "Mastzellen." The coarse granules stain readily with basic dyes. They increase perceptibly in the blood of patients suffering from spleno-medullary leucocythæmia.

5. *Lymphocytes.*—These have a large spherical nucleus with a limited amount of clear protoplasm around it. They constitute roughly about 25 per cent. of the total colourless cells, and are said by some authorities to be immature leucocytes.

6. *Hyaline Cells.*—These have a large spherical nucleus, and around it more protoplasm than the lymphocytes have. The protoplasm is nearly clear, although it stains slightly with a basic stain such as methylene blue, which may possibly be due to the presence of very fine basophil granules. These cells are phagocytic, and have been named by Metchnikoff *macrophages.*

It must be remembered that the nuclei of all these varieties of colourless blood corpuscles are basophil, which means that they have a strong affinity for basic aniline dyes such as methylene blue.

THE LEUCOCYTES IN INFLAMMATION.—Professor Adami in his book on inflammation divides the leucocytes, concerned in the inflammatory process, into the three following groups :—

1. The *Hœmatogenous leucocytes,* which are those which

normally exist in, and are therefore derived from, the blood-stream. These have been already described above.

2. The *Histo-hœmatogenous leucocytes*, which include the lymphocytes, the hyaline cells of endothelial origin, and other cells which may be derived from the lymphocyte. These cells may have either passed into the inflammatory focus and the blood-stream, or may be the result of proliferation of cells already existing in the tissues.

3. The *Histogenous Cells* which originate locally as the result of local tissue proliferation, and not by passage into the parts from the blood-stream.

In all cases of acute inflammation, leading towards suppuration and abscess formation, it is the polymorpho-nuclear cells which, passing from the blood-stream, predominate. The polymorpho-nuclear leucocyte "is the characteristic pus cell. It is actively phagocytic, particularly for bacteria; secretes bodies of the nature of enzymes, and, either while active or in the process of dissolution, liberates antitoxic and antibacterial substances." This cell has nothing to do with the formation of new tissue. The eosinophils are rarely found in the inflammatory process though they are noticeably increased in number in certain diseases such as when trichinæ and intestinal parasites exist in the patient. These cells take no part in the formation of new tissue.

The coarsely granular basophil cells, or mast-cells, are particularly well seen in sub-acute inflammations. Maximow shows that, in the course of the process of inflammation, these cells disintegrate.

The lymphocyte is only slightly amœboid, and does not migrate very actively from the blood vessels to the injured area in acute inflammations. In certain chronic inflammations, however, it is the preponderating cell, and is the chief element in the small round-celled exudation. It is not phagocytic for bacteria, but may ingest particles of inert matter.

The histogenous wandering cells appear in the inflamed area at a later period than the polymorpho-nuclear and eosinophil cells, nevertheless they exhibit phagocytic properties towards bacteria. They are not so active as the polymorpho-nuclear cells, but they are peculiarly active as regards other cells and cell-debris. They are slowly mobile, and some are derived from the vascular endothelium. They multiply by direct cell division, and also by karyokinesis. They may either completely disintegrate, or form giant-cells by plasmodial fusion, or direct division of the nuclei, or they may be active in the formation of new tissue. The giant-cells, seen in chronic, simple, or tuberculous inflammation, are most probably derived from these histogenous wandering cells by a plasmodial fusion of a number of cells.

HAY FEVER.—According to the teaching of Mr. Charles A. Parker, hay fever is closely allied to paroxysmal rhinorrhœa, and vaso-motor turgescence of the mucous membrane of the nose. If the mucous membrane of the nose of a patient, suffering from hay fever, is examined, it will be found to be in a turgescent condition, due to a vaso-dilatation of the blood-vessels, which exist there in great abundance. The patient has violent attacks of sneezing, and, as a rule, a profuse watery discharge from the nose, there may also be a certain amount of lachrymation, and, not infrequently, the patient suffers from attacks of spasmodic bronchial asthma. There are three factors, which are usually associated with hay fever, namely, (1) a local exciting cause; (2) a peculiar condition of the nasal mucous membrane, rendering it hyperæsthetic; sometimes, however, a local morbid condition may be found, if carefully looked for, such as nasal polypi, a spur, or a deviation of the septum nasi, or enlarged middle and inferior turbinals; (3) a particular idiosyncrasy on the part of the patient, the neurotic temperament oftentimes being very pronounced, and, in this connection, it should be remembered that even the sight of artificial roses has brought on an attack. In some cases, there may be a very definite neurotic family history. With regard to the local exciting cause, the commonest is said to be the pollen of certain flowers and grasses, though, in certain individuals, the smell of some flowers, such as roses, and the exhalations from animals, such as rabbits, guinea-pigs, and cats, may suffice to bring on an attack. It must be remembered, however, that any one of the three factors mentioned above may be absent. The symptoms usually set in abruptly, and the attack may last from a few hours to a few days, oftentimes ceasing as suddenly as it began. The attacks often recur during the hay-making time. The attacks of asthma usually commence soon after the onset of the nasal symptoms, although, occasionally, the asthmatic attack does not occur until night, or early in the morning. In treating a case of hay fever, the most important thing to do is to carefully examine the nose, in order to find out if there is any definite lesion or deformity, which, if found, must be at once remedied.

Since the underlying predisposing cause is often a *neurosis*, general treatment must be resorted to, and many drugs have been used. It is important, however, first to attend to the digestion of the patient, and to see that the bowels act regularly before trying a definite course of treatment. Mr. Parker recommends the following medicine :—

℞ Liquoris Arsenicalis - - - ♏iij.
Sodii Bicarbonatis - - - - gr. x.
Tincturæ Calumbæ - - - ♏xx.
Aq. Chloroformi - - - ad ℥i.
Misce. Fiat Mistura.

Two tablespoonfuls to be taken three times daily, after food.

If the patient is at all anæmic, it will be advantageous to combine some preparation of iron with the arsenic, and the following mixture is also recommended :—

℞. Ferri et Ammonii Citratis - - gr. viij.
Tincturæ Nucis Vomicæ - - ♏v.
Liquoris Arsenicalis - - - - ♏iij.
Ammonii Carbonatis - - gr. iij.
Aq. - - - - - - - ad ℥i.
Misce. Fiat Mistura.

Two tablespoonfuls to be taken three times daily, after food.

The following pill has also been found to be especially useful in those cases in which the neurotic element is pronounced :—

℞. Zinci Valerianæ - - - gr. i.
Pil. Aloes et Asafœtidæ - - - gr. ij.
Misce. Fiat Pil.

One pill to be taken twice or three times daily after food.

At the same time, it may be necessary to remove the patient from the district in which the source of irritation exists.

Preparations, Inventions, etc.

ST. JAMES' ELECTRIC AND LIGHT BATHS.

(1, York Street, Jermyn Street, S.W.)

Treatment by light and electric baths and massage, in cases of gout, rheumatism, weak circulation, paralysis, and kindred ailments, has gradually become a recognised valuable adjunct to the administration of drugs, if not, in some cases, a useful substitute for them. For cases of irritable nerves, the sinusoidal current is very effective. We need scarcely add that this is an alternating faradic current, in which the potential gradually rises from zero to a maximum, and then gradually returns to a minimum. We understand that the St. James' Baths are under the management of Mrs. Wiseman, who is assisted by an efficient staff of masseurs and masseuses.

PREDIGESTED LIQUID FOODS.

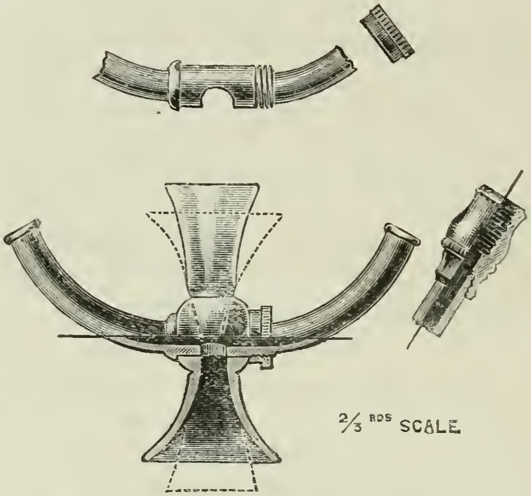
(Messrs. Parke Davis & Co., 111, Queen Victoria Street,
London, E.C.)

Nutritive Liquid Peptone is a palatable nutritious restorative, presenting prime beef reduced to bitterless peptone by means of brometone, the proteid-digesting ferment of pine-apple juice, in association with extract of malt of high diastasic power. As a true food, in an easily assimilable form, possessing gently stimulating properties, it can be relied upon, in critical illnesses, to maintain nutrition for days, and, during convalescence from debilitating diseases, it is a valuable means of promoting nutrition. It is supplied in bottles of 8, 16, and 80 fluid ounces.

Nutritive Liquid Peptone with Creosote is the preparation referred to above, with the addition of 1¼ minims of beechwood creosote and ¾ minim of guaiacol to each fluid ounce. These additions increase its usefulness in gastric disorders, and in cases of tuberculosis, phthisis, and chronic bronchitis, render it valuable for improving nutrition, stimulating appetite, and lessening cough. It is also supplied in bottles of 8, 16, and 80 fluid ounces.

AN IMPROVED CHEST-PIECE FOR BINAURAL STETHOSCOPES.

This chest-piece, designed by Dr. Ross, can be obtained from all dealers in surgical instruments. As shown by the illustration, the body is made so that it revolves, the larger end being used for general chest examination, the smaller being suitable for intercostal and supraclavicular examinations. The instrument is in three parts, the actual chest-piece, the curved arms to which the tubes are attached, and a metal screw cap, which serves the alternative purpose of making the chest-piece quite rigid, or of allowing the whole to be taken apart for sterilisation. The revolving body is in one piece of metal or ebony, thus obviating the necessity of unscrewing for intercostal examination, as is the case in most binaural stethoscopes. Stethoscopes, now in use, can also be used with this instrument, for silk or mohair tubes can be easily fitted by means of the special mount, shown separately, which is screwed on to both ends of the arms.



"TABLOID" SLIPPERY ELM.

(Messrs. Burroughs Wellcome & Co., London.)

The mucilage of slippery elm is well known and largely used as a demulcent and sedative astringent. Alone, or combined with phenol, it is employed locally in pharyngitis and other throat affections, and, internally, in diarrhœa and dysentery. The "Tabloid" Slippery Elm is a very convenient and trustworthy means of administration. Each contains 5 gr. (·324 grm.) of mucilage, and one or more may be readily dissolved in the mouth, or swallowed with a little water. These "Tabloids" are issued in bottles of 25 and 100.

THE PRACTITIONER.

OCTOBER, 1907.

VALVULAR DISEASE OF THE HEART.

By RAYMOND CRAWFURD, M.A., M.D., F.R.C.P.,
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VII.—PULMONARY REGURGITATION.

In pulmonary regurgitation there occurs on the right side of the heart, as in aortic regurgitation on the left, reflux of blood during diastole into the corresponding ventricle. It is certainly the rarest of all valvular lesions; or, perhaps, it would be safer to say that it is the lesion, the existence of which is the least often detected during life, and confirmed by post-mortem examination, for it is arguable that functional incompetence may exist during life, and yet leave no trace of its existence after death. The condition may originate in disease, or in defect of the valves themselves, or in dilatation of the pulmonary orifice, and usually of the artery as well, without any abnormality of the valves. In the latter case the valves are merely unable to close an abnormally large orifice. Thus there are two clear types of pulmonary incompetence, *structural* and *functional.*

There is this sharp contrast with aortic regurgitation that this functional form of incompetence is actually more common than that due to structural disease. It is the outcome of persistently high pressure in the pulmonary circulation, and is, therefore, associated with mitral stenosis far more frequently than with all other causes combined. Indeed only emphysema can claim, as well, a direct causal connection, and even this is open to dispute.

We have seen that safety-valve reflux at the tricuspid orifice is a physiological fact. At the mitral orifice, a similar leak occurs, under quite temporary conditions, and, although not in the strict sense physiological, readily disappears with their removal. In each case it is the yielding musculature of the orifice that permits regurgitation. At the aortic and pulmonary orifices we have to do, not with a yielding muscular sphincter, but with an unyielding fibrous ring. Hence the relative infrequency of functional incompetence at these sites, and the greater tendency to permanence when it does arise. But that such does occur, under conditions of prolonged and persistent high pressure at the pulmonary orifice, is certain, and, at the aortic orifice, even in the absence of aortic atheroma, at least probable. Gibson showed, experimentally, some years ago, that the pulmonary valves of the human heart became incompetent with a column of fluid of more than 8 inches resting upon them; and that, with ever so slight a constriction of the orifice, by means of a band at the level of the attachment of the valves, they were enabled to carry a column of no less than 6 feet. Further, that the incompetence varied with the degree of relaxation or constriction of the orifice. These experiments afford demonstrative proof of the possible production of the defect, under the influence of high pressure in the pulmonary circulation, such as is found in mitral stenosis, and, at times, in emphysema. The dilatation of the orifice is commonly explained as the consequence of distension of the elastic artery. If this were so, one should find post-mortem more often than is the case, dilatation of the pulmonary artery. The suggestion that the dilatation may, in such cases, have disappeared with death, though possibly correct, seems hardly probably so, since, with long-maintained high pressure, the arterial wall will lose its elasticity. We do actually find extensive atheroma of the pulmonary artery. One is tempted to regard the dilatation of the orifice as arising *a tergo*, in the train of the dilatation of the infundibulum of the right ventricle, which is so prominent a feature in the morbid anatomy of pulmonary regurgitation.

Even less common than this functional incompetence, due to stretching of the pulmonary orifice, is regurgitation, due to structural disease, or defect of the valves. Such disease may be congenital, or acquired, the latter being far the more common. In congenital cases, we meet more often with defect or malformation of the valves than with disease. The recognised congenital defects are deficiency in the number of the valves, fenestration of their substance, and malformations, each of which may cause pulmonary incompetence. Fœtal endocarditis, at this orifice, typically produces stenosis, and it is remarkable that the constriction is so rarely associated with clinical evidence of incompetence. A narrowed orifice will tend, of course, to lower the pulmonary blood pressure, and diseased valves are more likely to be competent in a narrow than in a normal orifice, and with a low blood pressure ahead than with a high.

The acquired lesion may be referable either to degenerative sclerosis, or to vegetative endocarditis. In the former case, it is almost invariably a sequel of mitral stenosis, that has set up by reason of the continued high-pressure atheroma, not only in the pulmonary artery, as in the type of functional incompetence, but in the valves as well. When due to acute endocarditis, the precise causation is less clear. The absence of a history of acute rheumatism has been noted by several writers. Against this must be set the latency of acute rheumatism in childhood, the age at which acute diseases of the pulmonary valves is most liable to arise. It is true that the lesion, in the majority of cases, is of the so-called malignant infective type, and is immediately referable to the organisms of gonorrhœa, pyæmia, or puerperal fever, and of other infectious fevers ; but these are apt to be grafted on to valves, already injured by antecedent rheumatic disease, fœtal or post-natal. The not infrequent association of the infective endocarditis, with defects of development in the heart, suggests that the malignant infection is an accretion of later date.

Pitt describes aortic aneurysm pressing on the pulmonary artery as an occasional cause of pulmonary regurgitation, and, in confirmation of this, mentions several museum specimens in which the adjacent aneurysm has led to inflammation and adhesion of the cusps to the wall of the pulmonary artery. In such a case, it would be very difficult in life to be sure of the presence of pulmonary regurgitation, as, with an aneurysm of this part of the aorta, there would almost inevitably be aortic regurgitation as well.

There is little or nothing of distinctive character in the morbid anatomy of pulmonary regurgitation. Congenital disease has nothing to distinguish it from the same condition at other orifices of the heart. It is usually associated with developmental defects, such as patency of the ductus arteriosus or foramen ovale, or with an aperture in the septum of the ventricles. The necessity of channels of relief, by way of the septa of the auricles or ventricles, in the presence of obstruction of the pulmonary orifice, is intelligible, even if it is difficult to explain in the chronological order of fœtal development. In the absence of these defects, we are still apt to find simultaneous affection of other orifices of the heart, all adding to the difficulty of clinical detection.

When the disease of the valves has originated in endocarditis, during childhood or in later life, they are commonly shrunken, indurated, and even calcareous, and, at times, fused together by union of their adjacent surfaces. With this distortion of the valves, there may also be evidence of an old vegetative process ; or, more commonly still, a true infective process with fungating vegetations, and more or less distinctive ulceration of the valves. Such have, in rare instances, been associated with aneurysm, perforation, or rupture of the valves.

In the functional cases, there is some degree of dilatation of the orifice, and, though the valves themselves may be healthy, more or less atheroma is found in the pulmonary artery and its branches, as the sequel of the causal mitral stenosis. At times, the size of the orifice is not appreciably increased, while the artery is distinctly dilated and even pouched, a condition brought about by the abrupt distension of the elastic coat during systole of the hypertrophied ventricle.

The first, and an invariable change in the wake of the valvular lesion, is dilatation with hypertrophy of the right ventricle, and, subsequently, the same changes in the right auricle, with, sooner or later, persistent incompetence of the tricuspid valves, and the generalised effects of this incompetence on the abdominal viscera and body surface. The lungs, too, though bearing no direct impress of the lesion, incidentally do not escape unscathed. When mitral stenosis is the exciting cause, there are the usual evidences of passive congestion, most marked at the bases, and, at times, pleural effusion as well. Pulmonary infarction too is not infrequent, arising in the atheromatous areas of the small arteries, and possibly also from emboli carried into the lungs from the right ventricle. The frequency of the concurrence of pulmonary regurgitation with mitral stenosis, and the infrequency of associated pulmonary stenosis serve to explain the absence of any special susceptibility to pulmonary tuberculosis.

It cannot be said that there are any symptoms indicative of pulmonary regurgitation; indeed its very existence is often latent; at other times, it is detected only by the physical signs. Such symptoms as there may be are those common to valvular lesions in general, shortness of breath, palpitation, sometimes cyanosis, and usually troublesome cough. Even these are masked by, or merged in, the obtrusive symptoms of mitral stenosis in a very large proportion of cases, and, if ultimately the tricuspid valve gives way, the familiar backwardation symptoms arise.

It is on the presence of a murmur, and the ability to distinguish it from other murmurs, that we have to depend for the detection of pulmonary regurgitation. It is, however, quite possible that at times pulmonary regurgitation may be present without an audible murmur; such a condition is conceivable in the presence either of pulmonary stenosis, or tricuspid regurgitation, each of which tends to lower the pressure in the pulmonary artery. When a murmur is present, it is early diastolic in time, either replacing the pulmonary second sound, or far more commonly arising, so to say, out of it. The pulmonary second sound is then generally accentuated, and occasionally reduplication in the pulmonary area may be heard as well. The murmur, in my experience, is always soft and blowing in quality, and of short duration. Others have described rasping and hissing murmurs. It is apt to vary much in intensity, even from day to day, indicating, no doubt, varying degrees of pressure in the pulmonary circulation, and it may completely disappear with rest. As a rule, it is best heard in the third left interspace, some 2 inches from the left border of the sternum. It is confined to a small area, its only line of conduction being downwards and that for 2 or 3 inches at most. I know no sure record of a diastolic thrill associated with the murmur. Seeing how difficult it is to detect the vibrations with the ear, one would hardly expect to feel them with the hand. Now and again, the pulsation of the conus arteriosus is visible in the second or third left interspaces, and the enlargement of the right ventricle is indicated by the area of cardiac dulness, increased mainly upwards, but also to the right of the sternum, and by well-marked epigastric pulsation.

Since, with few exceptions, pulmonary regurgitation is either a late consequence of mitral stenosis, or a malignant infective endocarditis, the duration of the disease can hardly be prolonged. In the former case, one may, in the absence of accidental pulmonary complications, expect the slow downward course of progressive heart failure. This, however, is not invariable. For the last five years, I have had the opportunity of seeing, at intervals, a young girl with mitral stenosis, in whom, at times, the murmur of pulmonary incompetence is distinct and indisputable, whose general condition has notably improved in this period, and who now seems to have every prospect of some years of uncrippled life before her. The prognosis, however, is always bad, and if the symptoms indicate a severely infective process, the end cannot be long delayed. The concurrence of stenosis with regurgitation may introduce a liability to pulmonary tuberculosis, but can hardly make a bad prognosis worse.

Perhaps it is around the question of differential diagnosis that the greatest interest centres. We have already indicated, as an essential feature in the diagnosis of pulmonary regurgitation, the presence of an early diastolic murmur, soft and blowing in character, best heard some 2 to 3 inches from the left border of the sternum in the third intercostal space, and conducted directly downwards no lower than the fourth intercostal space. Such a murmur will need the clearest differentiation from that of aortic incompetency. One not infrequently sees the murmur of aortic regurgitation ascribed to incompetence of the pulmonary orifice, but when true pulmonary regurgitation is present, there is little likelihood of the reverse mistake. The confusion is largely referable to the traditional teaching that aortic regurgitation is best heard to the right of the sternum ; yet, in a large proportion of cases, it is the so-called pulmonary area that is the site of maximum intensity of an aortic regurgitant murmur. The pulmonary murmur is one of less strength and less volume than the aortic. The former is a low-pitched murmur, the latter of relatively high pitch. The carriage of the murmurs, too, is quite distinct; an aortic bruit is often propagated into the vessels of the neck, a pulmonary never. An aortic murmur is generally conducted along the fourth and fifth ribs to the apex, and, at times, is loudest there; even when it travels directly downwards, in the same line as the pulmonary murmur, it travels much further, and is usually clearly audible at the ensiform. In pulmonary regurgitation, there is no collapsing pulse, no visible pulsation of the arteries, and no capillary pulsation, as in the aortic lesion; then again the signs of enlargement and of embarrassment are in the right heart, not in the left.

Aneurysm of the aortic arch is spoken of as likely to be confounded with pulmonary regurgitation; indeed, at the present time, I have under my care a case in which the mistake was made. To faith without sight all things are possible, but it is difficult to see how confusion could have arisen, if the patient's clothes were removed before making the diagnosis. This aneurysm presents, beneath the second and third left intercostal spaces, some 2 to 3 inches from the sternum. There is a double murmur in this position, that can be continuously traced back to the aortic valves, and the diastolic element has the character of an aortic regurgitant murmur. The area of dulness, due to the aneurysm, could not be mistaken for the conus arteriosus, as it is marked off below by a zone of resonance from the enlarged area of cardiac dulness. The whole left side of the chest heaves with the movements of the powerful and dilated left ventricle, but the pulsation of the aneurysm is an obviously circumscribed pulsation, quite distinct from the general left thoracic movement. And if further proof were necessary, it is to be had in the small left radial pulse, in paresis of the left vocal cord, and in compression of the upper portion of the left lung.

There is much greater likelihood of assigning to mitral stenosis a murmur, that is really due to pulmonary regurgitation. Typically, however, the murmur of mitral stenosis is late diastolic, while that of pulmonary regurgitation is early diastolic; the former is a rough rumbling crescendo murmur, the latter, soft and blowing. The distinct locality of the two murmurs, and their strict confinement, except in rare instances, to those areas should raise a suspicion, which will be confirmed by the presenceof the very characteristic associations of mitral stenosis. But mitral stenosis is so often present along with pulmonary regurgitation, that one has to depend on the presence of two murmurs, during diastole, differing in location, in time, and in character.

Assured of the existence of pulmonary regurgitation, we may still wish to know whether the lesion is due to structural disease of the valves, or merely to function incompetence. It is impossible to do more than balance the probabilities. In the former event, in quite a large number of cases, we shall find evidence of the septic nature of the process, in the examination of the blood, in the course of the fever, in the associated signs of sepsis, and perhaps in the discovery of a focus of infection of the blood stream.

There are no special indications for treatment in pulmonary regurgitation other than those applicable to valvular disease in general.

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MOVABLE KIDNEY.

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[With Plate XII.]

HISTORICAL.

No treatise, which attempts to deal with such a subject as movable kidney, can be complete, unless it includes a short account of the steps by means of which our present knowledge of the condition has been reached.

We propose, therefore, to give a brief *résumé* of the views which have been held on the subject by the earlier writers. Mesue, of Venice, writing in 1561, seems to have been the first to draw attention to movable kidney, but appears to have regarded it as a condition chiefly to be found as a consequence of some form of renal tumour.

In 1581, dislocation of the kidney, arising from internal, or external (traumatic), causes, is referred to by François Pedemontanus, but Riolan was the first to recognise the clinical importance of the condition, and to point out that rapid diminution of the perirenal fat played an important part in its production. In his book, published in 1682, he says: "Although the kidneys appear strongly fixed in the loin, they may still be able to leave this position, and move downwards or fall forwards. The cause of this is not only that the fat, in which they are normally enveloped, disappears, but further, either from enlargement due to tumour or stone in their pelvis, their own weight pulls them down, their attachments not being sufficiently strong to hold them in place."

Pierre Rayer, in his *Traités sur les Maladies des Reins*, published in 1839, gives the first full account of the condition, and its symptomatology. He appears, judging from his own account, to have been the only physician of the time well acquainted with the pathological mobility of the kidney, though he refers to Riolan's writings. In his book, he states that women furnish the largest number of patients, and that the kidney is most often found movable on the right side. It is also, he says, often associated with a hypochondriacal frame of mind. "Especially in those who discover for themselves a tumour in the abdomen, the nature of which their physician is unable to explain." He refers to a medical man, who, discovering such a tumour one day when in his bath, retired from the profession, and resigned himself to death. He describes also a case of "floating kidney" in which a mesonephron was present, and which he considered a congenital anomaly, owing to the great length of the renal vessels. He treated his cases, as a rule, by ordering a corset or bandage, which, however, he states, only gave partially satisfactory results. This he combined with a diachylon plaster, and rest in a horizontal position. As an instance of the symptoms of such cases, he quotes the following account of a woman, aged 43, who complained of intermittent gastro-intestinal derangements, and who was a permanent hypochondriac. On examination, he found a tumour in the right loin below the margin of the liver, firm, smooth, and kidney shaped. This was movable almost to the umbilicus. "He could take it in his hands." It was quite separate and easily distinguished from the gall bladder. In the lumbar region was "*un vide*." The left kidney was not felt. The patient was married, had one living child, and had had two miscarriages (figures which he quotes, possibly, for the purpose of showing the relation of pregnancy to the condition).

He carried out his routine treatment on this case with the result that the pain, usually experienced on movement, was much relieved.

Another of the earlier writers was Landau, whose book, admirably translated and edited by Champneys (New Syd. Soc., 1884), is a valuable contribution to the literature of the subject, not only on account of its wealth of clinical material, but also because it contains careful records of numerous post mortem examinations, made with the special object of elucidating the cause of the condition.

The operative treatment of movable kidney is of comparatively recent date. King performed an exploratory laparotomy in order to remove a movable tumour (probably a floating kidney), but, on opening the abdomen, he was unable to find it.

Hahn, in 1881, recorded two successful cases of lumbar fixation, and gave to the operation the name of nephrorrhaphy, afterwards known in France as nephropexy. His subsequent results, however, do not appear to have been so satisfactory, failure being undoubtedly due to his faulty technique. His method was to sling the kidney into position by means of catgut sutures, which merely traversed the capsula adiposa. His principles, however, were sound, and showed a great advance on those of Martin, of Berlin. The latter, in 1878, had performed nephrectomy, and, by so doing, in addition to subjecting his patient to an operation, which at that time had an exceedingly high mortality, had removed an important organ, whose functions were probably only slightly, if at all, impaired.

Hahn, recognising that his method was not always successful, soon modified his original procedure, and adopted direct renal fixation. In this, he soon gained the support of numerous other surgeons, among whom one must mention Morris, Tuffier, of Paris, who employed partial decapsulation, and Vulliet, of Geneva, who used a detached tendon of the sacro-lumbalis as his suturing material. These surgeons laid the foundation for the innumerable operations now in vogue, all of which may be regarded as elaborations, or slight modifications, of their original methods.

DEFINITION AND CLASSIFICATION.

In dealing with such a subject as movable kidney, it becomes of the utmost importance to understand exactly what is meant by the term, and to arrive, if possible, at some practical basis for a classification. Hitherto, a certain amount of misconception has existed, as a result of which most of the statistics on the subject are entirely valueless, from ignorance of what the various observers chose to regard as pathological mobility of the organ in question. In addition to this source of error, variations in nomenclature have played their part in adding to the confusion. The word "movable" has been applied to the kidney from three different points of view, namely, clinical, anatomical, and pathological, and in addition to this, we have the class of kidneys described as "floating" to reckon with. Morris confines the term "movable kidney" to one which possesses freedom of movement in one plane only, the vertical, and reserves the term "floating" for those kidneys, which, in addition, possess freedom of movement towards the anterior abdominal wall.

It is now commonly acknowledged, though Landau held a contrary view, that the normal kidney has a certain definite respiratory excursion, and it is obviously necessary to arrive at some conclusion regarding the extent of this movement, before we can assert that any kidney possesses abnormal mobility. This respiratory excursion has been stated differently by various authorities, Morris and Dentu agreeing closely, however, in fixing 2–5 cms. or 3–5 cms. as the normal range. Treves, however, considers this estimate too high. It is probable that the position of the body, at the time of observation, has an important influence on renal mobility. As a rule, greater respiratory excursion is noted, in cases of lumbar operation, than when the abdomen is opened from the front. The explanation of this is not far to seek, for the kidney owes its movement on respiration to the liver. It probably is not influenced *directly* at all by the diaphragmatic movements, as the part of the diaphragm, with which the kidney is in contact, shows little or no respiratory change. In the semiprone position, adopted in the lumbar operation, the kidney is of necessity brought into closer relation with the liver than it would be with the patient lying flat on the back. Our own observations would agree with the range of movement already given as normal for the right kidney, whilst observations, made during the course of abdominal sections, have convinced us that the left one moves very little, if indeed it moves at all.

Some authors have exaggerated the frequency, with which movable kidney occurs, by including in their statistics all cases, in which the kidney is palpable. This, we consider, is quite unjustifiable. In about 60 per cent. of the women, whom we have examined with special reference to this point, in the surgical and gynæcological wards at St. Bartholomew's Hospital, we found at least the lower pole of the right kidney palpable; yet, in none of these cases, could abnormal renal mobility, in our opinion, be said to exist.

This brings us to the question as to what circumstances justify the diagnosis of movable kidney. In our opinion the following do so :—

(1) Excessive respiratory descent; meaning thereby that

the excursion shall exceed 2–5 cms., and that, in consequence, not only the lower pole, but most of the anterior surface of the kidney shall be palpable on deep inspiration.

(2) Cases in which abnormal mobility may be communicated to the organ from the exterior. This includes those cases in which the organ is so displaced as to be no longer influenced by the respiratory movements.

(3) When rotation of the kidney, alone, or in combination with descent, is able to take place. In the first of these conditions the kidney would not be palpable through the abdominal wall.

As a rule, we have found, in most cases of movable kidney, that a varying amount of prolapse of the organ has taken place, by this we mean that the centre of the kidney at rest, is on a lower plane than normal, and does not merely undergo increased respiratory excursion.

As to degrees of mobility, various classifications have been made. Glenard, for instance, formulates four classes :—

(1) Kidney descends on inspiration, so that the lower pole can just be palpated.

(2) Kidney can be held between the fingers, but the upper extremity cannot be defined.

(3) Tissues above the upper pole of kidney can be compressed, and some definition of the upper pole made.

(4) Kidney "floating," and can be felt during expiration by mere palpation. The floating kidney is uninfluenced by respiration, is usually to be found in the region of the umbilicus, but may extend well into the iliac fossa.

As we have already stated, we do not consider the first class at all abnormal, and any statistics based on this classification would, in our opinion, lead to quite erroneous conclusions.

Morris' classification is founded on an anatomical rather than a clinical basis. He considers that the kidney may possess an abnormal mobility within its tunica adiposa, this too within the perinephric fascia, or that both conditions may co-exist. As even post-mortem, it is extremely difficult to decide the exact points on which he relies for his classification, it is clear that, for clinical purposes at all events, it has little or no practical value.

To recapitulate somewhat, we find one or two chief characteristics in all cases of movable kidney, which must form the basis of a practical classification. They are—

(1) Increased respiratory excursion, or

(2) Change of position (accompanied by mobility), including under this heading,

(*a*) Prolapse.

(*b*) Rotation of one or other pole.

(*c*) A combination of *a* and *b*.

Now it is not possible to base a classification on the first of these alone, for the following reasons :—

First, and this may sound paradoxical, this increased respiratory movement is not always present in movable kidney. For instance, in cases in which there has been rotation of one or other pole, the most severe symptoms may occur, and yet no extra-respiratory excursion take place.

Secondly, because it is impossible to precisely determine how much movement shall constitute abnormal mobility. Assuming the normal range on movement to be about $\frac{1}{2}$ inch, can we say that $\frac{2}{3}$ inch is abnormal ; and, if we can say this, who shall decide through the abdominal wall between $\frac{1}{2}$ or $\frac{2}{3}$ inch excursion of a kidney ?

We are therefore compelled to fall back on the second of our two characteristics, but we must remember that change of position, except under class *b*, must always be accompanied by free movement. This reservation is necessary to exclude such cases as congenital displacement of the kidney. In these circumstances, the organ may be found in almost any part of the abdomen, *e.g.*, the iliac fossa, or a median (horseshoe) kidney may be present ; but it is almost invariably found more firmly anchored in position than a normal kidney.

We would therefore suggest the following classification :—

(1) Kidney which has merely prolapsed.

(2) Kidney has prolapsed and lower pole has rotated inwards. In this case, there is no expiratory return on abdominal nephroleptique, but kidney will return to normal position on recumbency.

(3) Kidney has prolapsed, lower pole rotated inwards, and has further undergone anterior displacement. There is, in this case, no tendency to return to the natural position on recumbency, but the kidney tends to become more prominent immediately beneath the anterior abdominal wall.

(4) Kidney has undergone rotation only; there has been no prolapse, it lies high up, and is often impalpable without an anæsthetic.

SOME POINTS ON THE ANATOMY OF THE KIDNEY BEARING UPON ITS PATHOLOGICAL MOBILITY.

We do not propose to describe fully, or in any sense to attempt a complete account of the anatomy and topography of the kidneys on this section; but merely to go into those points which we regard as of importance in the maintenance of these organs in their proper position, and which we have been able to verify by our own observations and dissections.

The kidneys lie in the lateral vertebral recesses, or kidney pouches, on each side of the spine in the lower dorsal and upper lumbar regions. These depressions vary very considerably in their shape and dimensions in the two sexes, and even in different individuals, and their antero-posterior diameter has a considerable bearing on the question whether the kidneys are palpable or no during life.

In one patient, a kidney may be distinctly palpable, whereas, in another patient, in whom the kidney lies on the same level, no part of it can be felt on clinical examination. The ease with which these organs can be felt also depends to a certain extent on the obliquity of the lower costal margin.

In men, the kidney pouches are deep, narrow, and rapidly diminish in breadth from above downwards, whilst, in women, they are much shallower and broader, and their transverse diameter is found to only slightly decrease as they are traced downwards.

Deletzine and Volkoff demonstrated these facts very clearly by an elaborate series of experiments, made by means of measurements and lasts, on the shape of the renal fossæ in the two sexes.

The kidneys lie with their long axes directed from above downwards and slightly outwards and occupy portions of the epigastric, hypochondriac, and lumbar regions. The lower pole of the right kidney extends as low as the lower border of the body of the 2nd lumbar vertebra, whilst that of the left is from about $\frac{1}{4}$ to $\frac{1}{2}$ inch higher. Laterally, the kidneys are entirely under cover of the ribs, in front the lower and inner third is exposed, and posteriorly the amount differs on the two sides.

On the right side, fully five-sixths of the organ lie below the level of the 12th rib, which merely skirts along its outer convex border, whilst, on the left, two-thirds of the kidney lie below the lower border of the last rib.

One is very apt to underestimate the extreme obliquity of the last rib, which is well shown in the accompanying drawing of a specimen in the anatomical museum of St. Bartholomew's Hospital (Fig. 1). In this dissection it will be seen that, although the upper renal pole reaches as high as the 11th intercostal space, even on the right side the tip of the lower pole lies no lower than a line drawn horizontally inwards from the tip of the 12th rib. The relative level of the kidneys may vary within a limit of one or more inches, and yet the pathological border may not be reached, as shown by the almost transverse course of the renal vessels.

The diaphragm is in relation with about the upper third of the posterior surface of the right kidney, and slightly more of the left.

This part of the diaphragm is entirely muscular, and its fibres can be seen passing almost vertically upwards from the ligamentum arcuatum externum to their insertion into the central tendon. Their curve is so slight that its obliteration on inspiration can have but little effect in the production of the normal respiratory descent of the right kidney.

The right pleural sac, although it extends below the vertebral end of the 12th rib, does not pass normally beyond the lower border of that portion of the rib which is in relation to the posterior renal surface.

Relations of the Colon (*see* previous drawing).—Although in the adult, the exact relationships of the large intestine to the kidneys vary, still the following broad differences on the two sides remain constant.

(*a*) That on the right side the ascending colon and hepatic flexure lie mainly on the inner aspect of the kidney.

(*b*) That on the left side the descending colon lies to the outer side, and partly astride, of the corresponding organ, the branches of the colica sinistra passing tranversely outwards across the anterior aspect of the kidney to get to their distribution.

PLATE XII.

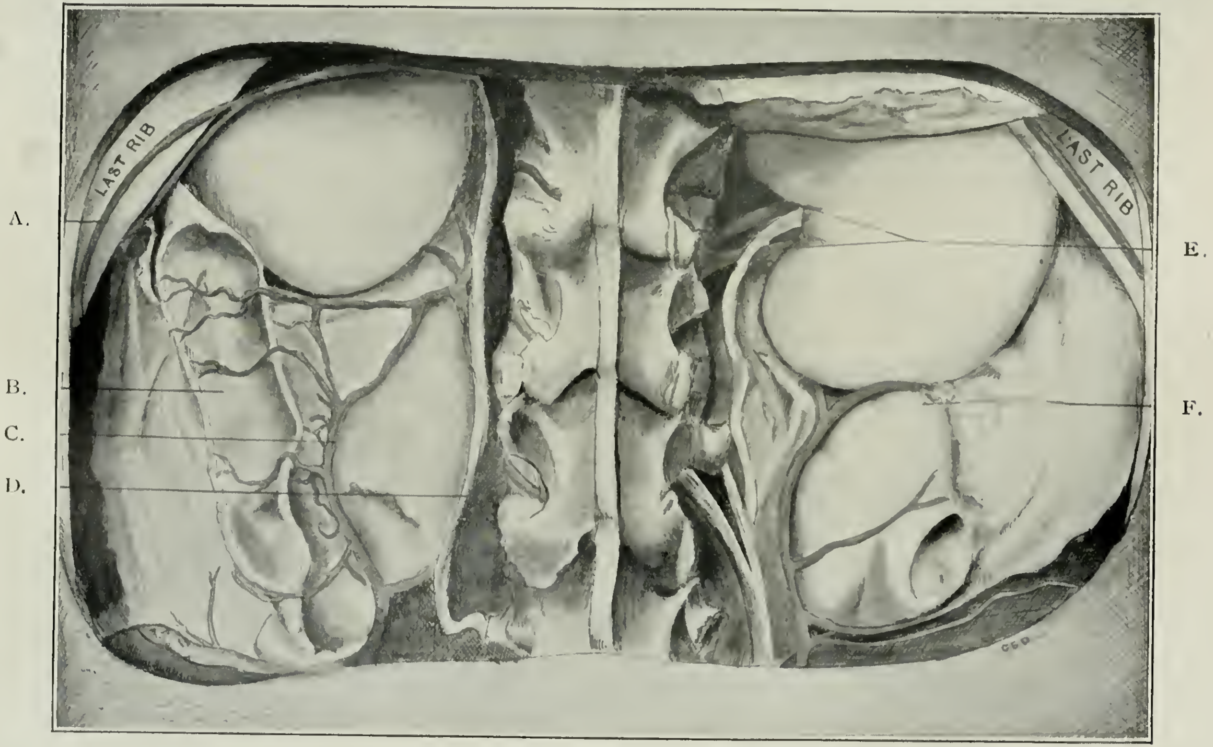


Fig. 1.—*Drawing of a dissection of the kidneys from behind.*

A. *Subcostal artery.* B. *Descending colon.* C. *Colica sinistra.* D. *Ureter.* E. *Terminal branches of right renal artery.* F. *Ascending colon.*

The splenic flexure of the colon lies above and well to the outer side of the upper pole of the left kidney, being firmly fixed, and supported in that position by the diaphragmato-colic ligament.

The usual arrangement is shown in the diagrams below, although the exact relationships are subject to a certain amount of variation in individual cases.

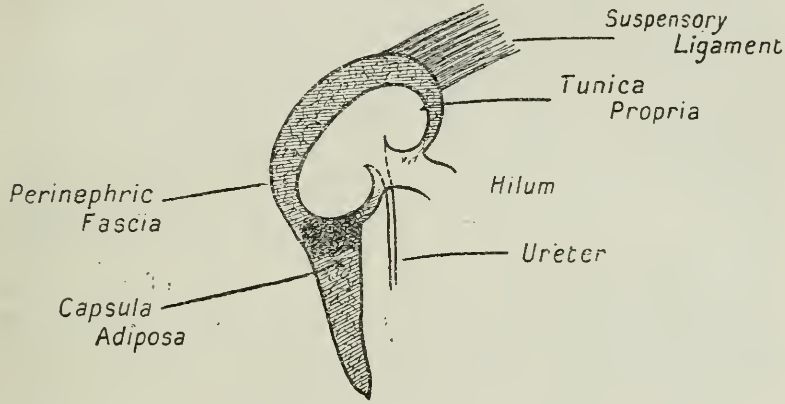


Fig. 2.

It will be seen that the hepatic flexure, should the bowel be loaded, would tend to drag on the kidney, whilst the descending colon, firmly suspended above, would, on the contrary, bind the kidney in position by means of its mesocolon.

Passing across the line of greatest convexity of the left anterior renal surface are also the pancreas and splenic vessels, both of which structures must be important factors in preventing any forward displacement of the organ.

In the normal adult, the lumbar fascial planes are so infiltrated with perinephric fat, and the adipose tissue, lining the lumbar recesses, that a satisfactory examination is well nigh impossible. When, however, a dissection is made of properly hardened specimens, either in the adult or in the fœtus, the fibrous investments of the kidney can be seen to have very definite limits and attachments.

They may be divided into three strata :—

(*a*) The capsule proper of the kidney.
(*b*) The capsula adiposa.
(*c*) The perinephric fascia.

(*a*) *The Capsule proper*, or tunica propria, consists of a thin semi-transparent layer of fibrous tissue, which gives a complete investment to the kidneys except just at the points of entry and exit of the renal vessels and ureter. As it is traced inwards, it is seen to dip into and line the renal sinus, and then to be reflected on to the renal vessels, with the tunica externa of which it soon blends, as it passes towards the middle line. The posterior layer of this reflection was named the suspensory ligament by Englisch, who attributed to it much greater importance in the support of the kidney than we think its strength warrants. He described it as passing inwards between the renal artery and ureter to gain attachment to the psoas sheath. Dipping inwards from the true capsule into the parenchyma of the gland are numerous delicate fibrous septa, which offer no bar to the decapsulation of the normal healthy kidney; but, in cases of generalised or localised interstitial nephritis, or perinephric inflammation, these may become much thickened, and render the capsule firmly adherent to the glandular surface.

(*c*) *The Perinephric Fascia* is best seen by a dissection made from the front.

The peritoneum can be dissected off with the colon, and then its anterior layer (fascia pro-renalis) is exposed.

The limits of the perinephric sheath can be demonstrated most satisfactorily if it is inflated with air by means of a small puncture in its anterior surface. When the transversalis fascia reaches the outer renal margin it splits into two layers, an anterior or fascia pro-renalis and a fascia retro-renalis, and it is by the reunion of these that the perinephric sheath is formed. These two layers form a complete investment for the kidney except at its hilum and lower pole. At the hilum, the fascia pro-renalis passes across the middle line to join the corresponding layer of the opposite side and the fascia retro-renalis, which is of slightly denser texture, partly blends with the psoas and quadratus lumborum sheaths, but also passes onwards to obtain direct attachment to the periosteum on the antero-lateral aspect of the vertebral bodies.

From its posterior surface also, a fibrous lamina proceeds inwards between the psoas and quadratus lumborum to be inserted into and blend with the periosteum on the lateral aspect of the bodies of the upper lumbar vertebræ immediately in front of the roots of their transverse processes.

At the lower pole, the two layers are continued downwards and slightly inwards, as a funnel-shaped prolongation, to end by blending together at a point on the iliac crest just external to the sacro-iliac joint of the same side. Here there is a weakness in the perinephric sheath, and it is down this channel that the kidney prolapses, and, guided by the direction of the funnel, the organ soon assumes a position with its long axis directed downwards and slightly inwards.

Passing from the upper part of the perinephric sheath, in an upward and inward direction, is a strong fibrous band, which is partly continuous with the diaphragmatic fascia, and partly attached to the vertebral bodies.

As the latter portion passes upwards it splits to enclose the suprarenal capsule, but there is by no means an equal division. Whereas the anterior portion is weak and thin, the posterior has considerable density and thickness, and constitutes such a strong band that we propose to call it the true "Suspensory Ligament" of the kidney.

This suspensory ligament, which can always be recognised as a tough band, offering considerable resistance to the enucleating finger in post-mortem examinations, together with the prolongation inwards of the retro-renal fascia at the hilum, we regard as important factors in the limitation of movement, and maintenance of the kidney in its proper position. As the pelvis of the ureter leaves the renal sinus, its calibre rapidly narrows until, at a point a short distance below its origin, it pierces the retro-renal fascia.

The portion of the ureter lying within the perinephric sheath is free to follow the kidney in all its movements, and thus a kink may be produced at its point of exit from the perinephric sheath, where, as it passes downwards on the psoas muscle in the extra-peritoneal fatty tissue, it becomes more fixed in position. Separating the fascia pro-renalis from the peritoneum clothing, the posterior abdominal wall is usually a thin layer of extra-peritoneal fatty tissue, which is present in fair quantity even in the seventh-month fœtus.

(*b*) *The Capsula Adiposa.*—The immediate surroundings of the fœtal kidney are almost entirely devoid of fat, except or one fairly constant patch lying along its outer convex border ; indeed, it is not until the child approaches puberty that the characteristic coat of adipose tissue makes its appearance. Up to this time the perinephric sheath is separated by a potential space from the tunica propria, and running across this interval are numerous branching aveolar septa, into the meshes of which fat is subsequently deposited in great abundance.

Although the capsula adiposa gives a more or less complete investment to the kidney, it is massed chiefly along the outer convex border and below the lower pole. In the latter situation, it forms a definite cushion of denser texture, which must lend support to the kidney in the erect position, occupying as it does the funnel-shaped prolongation of the perinephric fascia. It is completely cut off from the fat in the iliac fossæ.

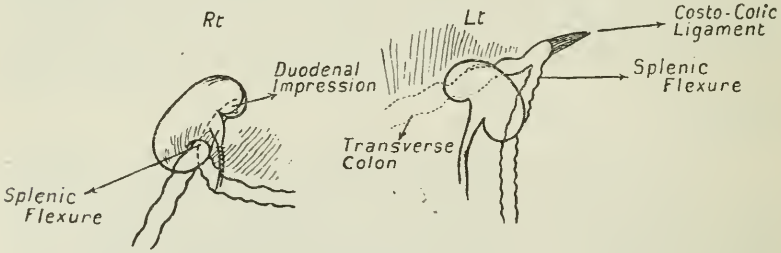


Fig. 3.

We received a striking demonstration of this fact in a specimen we dissected of congenitally misplaced kidney. In this case, the kidney lay with its lower pole well down in the right iliac fossa. It was enclosed in an exceedingly well-marked perinephric sheath, the lower limit of which reached the true pelvic brim. The fat, filling in its lower part, was completely separated from the iliac fat by the fascia retro-renalis, and bore the same relationship to it as the capsula adiposa does to the fat lining the lumbar recesses.

In connection with the left fascia pro-renalis, Zuckerkandl and Toldt have described an additional thickened process, to which they appear to have attributed much importance in the suspension of the left kidney, and have stated that is derived, during the process of development, from the descending mesocolon.

In our own dissections we were unable to identify this layer, or to satisfy ourselves that the fascial connections of the left kidney were in any way stronger than those of the right.

ÆTIOLOGY OF MOVABLE KIDNEY.

The first question which presents itself for consideration under this heading, must be the frequency with which abnormal renal mobility exists. That there is a great deal of divergence of opinion on this point is shown by comparing the statements of various authorities. These differ within fairly wide limits. Glenard gives 22 per cent.; Kuttner and Lindner, 20 per cent.; Morris, 7 per cent.; Skorczewsky, 3 per cent. in men and less than 10 per cent. in women as representing the frequency of occurrence. These figures were taken for the most part from clinical observations, and are therefore entirely dependent on what the various observers regarded as constituting a movable kidney. We have already remarked, and again repeat, to emphasise the fact, that in a large number of women, the lower pole of the right kidney is definitely palpable, and further that it moves on respiration. Such a kidney comes within the limits of Glenard's classification, and this fact probably accounts for the high percentage which he returns. As we have already pointed out, we do not think such a kidney should be regarded as "movable." From our own observation, we should say that less than 10 per cent. of women who present themselves for medical examination have a "movable kidney." One point is, however, in the true sense of the term, agreed on by all, namely, the greater frequency with which the condition occurs in women. As to the reason for this fact a variety of views exist.

Pregnancy has been blamed by many writers as an important cause of movable kidney, resulting in women suffering from the latter condition so much more frequently than men. Morris adopts this view to some extent, and gives the four following reasons for so doing :—

(i) There is a sudden loss of intra-abdominal tension during and after parturition.

(ii) The violent contractions of the diaphragm which take place during labour.

(iii) Post-partum flaccidity of the abdominal walls.

(iv) Too early return to ordinary occupations after delivery.

We are not able to agree that pregnancy plays any important part in producing movable kidney. In our series of cases, we found that 39 cases occurred in multiparæ, 37 in nulliparæ, and in 8 no definite history was obtained with regard to childbirth.

Kuttner agrees with our view that the condition is met with as frequently in the nulliparous, as in those who have borne children. If diminution in intra-abdominal tension played a large part in the production of a movable kidney, we should expect to find it occurring after the removal of large tumours, such as ovarian cysts, from the abdomen. This would be the more likely, since Nature provides no compensating mechanism in such cases as she does after parturition. But our statistics show that movable kidney is not a sequel to ovariotomy. In a large number of such cases which were examined at periods of from six months to five years after operation, only one of movable kidney, which dated from the operation, could be found. Most of this series of cases had been operated upon by Mr. Harrison Cripps, who insists on three weeks absolute rest in the supine position, after all his pelvo-abdominal operations. This may partly account for the low percentage of cases of movable kidney which resulted from the operation.

Violent contraction of the diaphragm may certainly produce an increase in the ordinary respiratory excursion of the kidneys, especially in the case of the right one. It is however questionable whether the contractions of this muscle, during labour, would be sufficient, *per se*, to dislodge the kidney from its normal position. In this connection, it is important to note that the ordinary conception of the movements of the diaphragm is an erroneous one. The muscle does not flatten itself out from side to side during inspiration, but the central tendon moves up and down like a piston. That this is what actually occurs can be shown conclusively by an X-ray screen examination. We have made many such with a special view of deciding this point. Since the diaphragm contracts in the manner described, its movements cannot directly affect either kidney, but can do so only through the medium of the liver.

Morris' third and fourth reasons are theoretically good, since post-partum flaccidity of the abdominal muscles would allow the perinephric fascia to be pulled on, in the event of the patient resuming an active occupation, before the muscles had regained their normal tone. In this connection, the statement, made on good authority, is interesting, that in certain European countries as many as 10 per cent. of the poorer multiparæ have movable kidney. Against this we must put the fact that, in parts of the Highlands, where the poorer women are in the habit of getting up on the fifth or sixth day of the puerperium, movable kidney is quite uncommon. The women, however, suffer much from uterine prolapse, caused no doubt by the giving way of the subinvoluted pelvic floor. This is in a large measure due to the fact that they resume an active occupation (carrying heavy fish baskets on their backs) too soon.

As regards social station, our experience points to movable kidney being as common, or perhaps commoner, in the well-to-do.

In our opinion, there are three factors which render women more liable to the affection than men :—

(1) The shape of the renal fossæ in women. As we have pointed out in the anatomical section of this work, the shape of the fossæ in the female sex is wider and shallower than it is in the male.

(2) Chronic constipation, which is admittedly commoner in women, and will also serve to produce the condition in the right kidney rather than the left.

Arbuthnot Lane, in a paper published in the *Clinical Journal* (June 5, 1901), draws attention to this factor. In chronic constipation, the cæcum and ascending colon get overloaded, and this tends to produce constant traction on the lower pole of the right kidney, with which the hepatic flexure of the colon is in immediate relation.

The upright position and straining at stool will both tend to drive the cæcum down into the pelvis, and thus to increase the drag on the right kidney.

On the left side, the relationship of the splenic flexure of the colon to the kidney is quite different (*vide* anatomical section), and does not exert the same downward traction.

(3) Tight lacing. This may undoubtedly assist in the production of a movable kidney. A specimen in the museum

at St. Bartholomew's Hospital shows this very clearly. At the same time it seems probable that the kidney in the first place may occupy, in such cases, a slightly lower position than in normal circumstances. The line of constriction, in those who tight-lace, appears to be lower than the maximum diameter of the kidney, and thus would tend to support rather than depress the organ. On the other hand, in cases, in which the pressure is considerable and exerted over a long period, the kidney appears to be affected through the undue constriction of the liver. It is most noticeable that a well-marked lingeform lobe of the liver, showing a transverse band of constriction above it, caused by tight lacing, is frequently accompanied by a movable right kidney.

Other well-recognised causes of renal mobility undoubtedly exist, besides those to which reference has already been made. Such are to be found in pathological changes of the kidney itself, or of surrounding organs, especially the liver, Glenard's disease, and as the result of trauma. In addition, we frequently find rapid loss of weight associated with a movable condition of the kidney. Occupation seems to play no very important part as a causative factor, except that heavy manual labour involves the risk of producing mobility of the kidneys through strain or accident.

Let us examine these causes a little more in detail. The pathological renal conditions, most often found associated with mobility, are new growth, especially suprarenal tumours, hydronephroses, polycystic disease, hydatid cyst, and stone. In many of these cases, it is of course uncertain whether the pathological changes present are the cause of the abnormal mobility, or are merely associated with it. It is quite clear that any of these conditions may give rise to such mobility. But it is equally certain, at all events in the case of hydronephrosis, that abnormal renal mobility, in many instances, existed prior to the development of the cystic condition, and, in fact, produced it. Tuffier, Morris, and Bruce Clark have all demonstrated this beyond doubt, and we ourselves have notes on a case, in which a movable kidney was observed to become hydronephrotic (*vide* Pathological section).

Traumatic cases are not very uncommon, and several instances have been recorded illustrating this point. In a case seen by one of us, the patient, a jockey, was thrown from his horse, which fell crushing him beneath. Within an hour or two hæmaturia, associated with pain in the right loin, was noticed. He recovered from the accident, but, during the next two years, several attacks of Dielt's crises occurred. The man was subsequently operated on, and what had been diagnosed as an enlarged movable kidney proved to be a very mobile hydronephrosis of fair size.

With regard to the part played in the production of movable kidney by rapid loss of weight, it is difficult to speak in decided terms. No doubt a history of loss of weight and of decrease in adipose tissue is often to be obtained, but, in many cases, the reverse is met with. It must further be borne in mind that the general adiposity of a patient forms a by no means trustworthy index as to the quantity of perirenal fat that may exist. As a rule, it is true, the common operative experience is to find, in these cases, a singular lack of fat in the renal fossæ. Still, in several of our cases this was not so. [If the operation is to be a success this occasional excess of fatty tissue has to be most carefully dealt with.]

The part that the fatty capsule plays in preventing renal ptosis is also somewhat uncertain. It is probable, however, that the pad of fat, lying below the inferior pole of the kidney in the perinephric funnel, does act, to some extent, as a support to that organ.

In Glenard's disease, a movable condition of the kidneys is one of the most constant phenomena. The cause is undoubtedly to be found in the general relaxation and stretching of the fascial plans which occur in this disease.

The right kidney is often found movable when the liver shows considerable enlargement, due either to fatty change, cirrhosis, or to new growth. In this case, direct pressure will account for the displacement.

Some authorities, among whom one might mention Albarran and Tuffier, hold that movable kidney is either a congenital condition, or, at all events, that a strong congenital tendency may exist, as evidenced by abnormally long renal vessels, a mesonephron, etc. It is stated, in some cases, to run in families. Though the tendency may exist, we cannot accept the actual occurrence of the condition as a congenital anomaly.

If it were so, children ought to suffer from movable kidney much more frequently than they do. It is rare to find a child suffering from this complaint. We have only once noted it in a child under 10 years of age (the patient was 2), and it is well known that a mesonephron, if it exists at all, is only very exceptionally found. Further, if congenital, one would expect symptoms to appear at puberty, the most active time in the child's life, yet this is not the case.

With regard to the somewhat rare occurrence of movable kidney in children, Jules Cromby has collected 18 cases, 8 of which occurred before the age of 10. Among the patients were 16 girls and 2 boys. G. F. Still has also recorded two cases, without symptoms occurring in children, in one of which the diagnosis was verified post-mortem.

As to the relative frequency with which movable kidney occurs on the two sides, we found it on the right side alone in 74 cases, on the left side alone in 16 cases. In four cases only, were both kidneys affected. In two of these, the right kidney was most involved, in two the left.

The reason for the right kidney suffering so much more than the left has been already referred to in discussing the actual causes of movable kidney.

With regard to age incidence, any accurate calculation is difficult. The reason for this is, of course, that many patients have movable kidneys, without being aware of the fact, and the discovery is made more or less by accident. All that we can arrive at is the age at which symptoms are complained of. In our series of cases, we found that by far the larger number occurred between the ages of 25 and 35. No less than 50 per cent. falling within this period.

As to sex, the condition is infinitely commoner in women than in men. The latter are rarely the subject of movable kidneys, unless of the acute traumatic type. The reason for this may be found on consideration of the causes, which, in our opinion, tend to produce abnormal renal mobility. In a consecutive series of 100 cases of abnormal renal mobility which we collected, in 89 instances the patients were women.

(*To be continued.*)

SOME POINTS IN THE TREATMENT OF DISEASES OF THE HEART.

By JOHN HAY, M.D., M.R.C.P.,

Assistant Physician to the Royal Infirmary, Liverpool; late Physician to Stanley Hospital, and to Hospital for Consumption and Diseases of the Chest, Liverpool.

THE recent work, dealing with the manner of the heart's activity, initiated by the classical research of Gaskell and Engellmann, and applied and enlarged by the remarkable investigations of Mackenzie and Wenckebach, has so altered our views as to the physiology of the heart's activity, and has so changed our conception of the causes underlying many of the well-known pathological conditions, that it seems opportune to consider our recently acquired knowledge from the point of view of treatment, and more especially to see how it affects our attitude towards digitalis and its allies. Until recently, the contraction of the heart has been viewed as corresponding with that of a muscle in a nerve-muscle preparation. I mean, of course, that the contraction of the heart muscle has been looked upon as the response of that hollow muscular viscus to a stimulus, arising in some portion of the nervous system, and that the nervous tissue, responsible for the creation of this stimulus was that of the cardiac ganglia. Now, however, owing to the remarkable work of Gaskell, this view named the "neurogenic" has given place to another, the "myogenic."

Gaskell proved that the heart muscle possesses in itself the power to originate its own stimulus to contraction, that the cardiac muscle fibres are able to conduct that stimulus from one part of the heart to another, that these fibres are excitable, and can respond by contracting in response to the stimulus when it arrives; he also demonstrated that the myocardium possesses the important characteristic of tonicity.

Further, these functions of the cardiac muscle are not possessed in an equal degree by all the fibres throughout the heart, but, in particular regions of the myocardium, some functions are more highly developed than others; for example, the function of stimulus production is most marked at the opening of the great veins into the auricles, the remains of the sinus venosus; the result is that the stimuli originating here initiate muscular contractions, which spread from this point over the auricles and ventricles. The function of tonicity, possessed of course by all the fibres, is present in a high degree in the muscular fibres surrounding the valvular openings and the openings of the veins into the auricles: while contractility is especially developed in the large thick walls of the ventricles.

Thus we see that, though every fibre possesses all five characteristics, certain groups of fibres, are more highly endowed with one function than another. In addition, we have the vagus and sympathetic nerves through which a constant stream of nervous influences plays on the heart, exalting or depressing, augmenting or inhibiting these functions of the cardiac musculature.

For example, nervous influences, acting through the vagus and the sympathetic, may affect the production of stimuli, increasing or diminishing the number of systoles per minute, though the nervous centres do not actually produce these stimuli, which originate in the heart muscle itself.

Long before the "myogenic" theory was evolved, it was very generally accepted that cardiac insufficiency spelled muscle inefficiency.

This theory has greatly emphasised the importance of the condition of the myocardium in all cases of heart failure, and as a result of its general acceptance, less and less stress is now laid on the nature of the coarse anatomical lesion.

As a rule, the functional activity of the myocardium is depressed or exalted as a whole, but Gaskell's work enables us to go further.

The statement that the heart muscle is inefficient does not satisfy us now, but we endeavour to analyse the inefficiency in order to determine which function or group of functions is at fault; for the muscle may fail in more ways than one; one or other function of the myocardium in any given case may be impaired, and the remaining functions be unaffected.

For example, the tonicity of the muscle fibres may fail while the production of stimuli and the power to conduct those stimuli remain normal, or are increased. Such a combination results in a dilated and frequently beating heart, and this, irrespective of the nature of the valvular lesion, if one is present.

I propose to consider the place of the members of the digitalis group in the treatment of cardiac disorders, and, so far as is possible at the present time, to discuss the action of this group on two of the special functions of the myocardium.

The various text-books on pharmacology, materia medica, and therapeutics are full of contradictions concerning the manner in which digitalis acts on the heart, and the only way to obtain peace of mind, among this conflict of opinion and theory, is to confine oneself entirely to one author, I do not think that it really matters to which.

There are, however, certain generally accepted views, namely, that the digitalis group acts :—(1) on the tonicity of the heart muscle, improving it ; (2) on the contractility, augmenting the force of the systole ; (3) on the frequency of the beat, by depressing the function of stimulus production or the excitability of the musculature, and this depression is brought about either by the action of the drug on the muscle fibres themselves or by stimulation of the end of the vagus nerve in the heart ; (4) in a toxic manner, and that this effect is a definite one when the drug is pushed.

Although the components of the digitalis group are much alike in their action, each element has certain very definite characteristics, and for a rational use of these drugs it is essential to have a lively appreciation of their peculiarities.

Haynes, of Cambridge, has recently done some valuable work on the pharmacological action of these three drugs, and he lays stress on one point, namely, the marked difference in their toxicity.

He found that the tincture of strophanthus was ten times more toxic than the tincture of digitalis, the tinctures having been prepared by him according to the British Pharmacopœia from especially selected plants. This is of some importance, when one remembers that the official dose of each tincture is the same.

He naturally emphasises the need that there is for an accurate standardising of the preparations of these drugs.

According to Haynes, the digitalis group acts directly on the heart muscle, stimulating it, and also indirectly on the heart muscle by stimulating the vagus nerve endings, the slowing of the heart action being chiefly, though not entirely, due to this stimulation of the vagus.

The later action of this group is to increase still more the tonus, and also to accelerate the rate by the extension of the action of the drugs to the function of stimulus production. We have, therefore, as the result of the exhibition of these drugs, first, an increase of tonus with slowing, last a still greater increase of tonus with increased frequency of beat. As a result of his experiments, he considers squills superior, as a cardiac stimulant, to either digitalis or strophanthus. He found that the commercial preparations of squills show less variations in strength, and a more constant action than digitalis. He showed that the amount of work done by the heart was greater in response to squills than to digitalis, and also that of the two squills is less irritating to the mucous membranes.

Strophanthus, according to Haynes, has less effect on the force of the heart than either squills or digitalis, but its slowing effect is more marked. Squills has greater action on the peripheral vessels, and on the coronaries, than either digitalis or strophanthus; whereas strophanthus has only a very slight action in constricting the peripheral circulation.

During 1906, I kept notes of the action of digitalis, strophanthus, and squills on a number of heart patients, and some of the results have been most interesting.

If there is one function of the heart which is admittedly influenced by the digitalis group it is that of tonicity, and there can be no doubt that, where one finds indications of depression of this function, some member of this group should be administered.

The anatomical change, associated with depression of tonicity, is lengthening of the muscle fibres; the result of this lengthening depends on the site of the fibres which have lost their tone. If they form the bulk of the ventricles, the result is a dilatation of the ventricles, and an increase in the amount of the residual blood at the termination of systole. If they form the bundles, situated around the auriculo-ventricular orifices, those orifices will not be adequately closed during systole, and the result is valvular incompetence. Again, there are certain muscular bundles, whose duty, during the systole of the auricle, is to close the orifices of those veins which debouch into the auricles. Loss of tone in these bundles results in incompetence at the venous orifices, and a venous pulse becomes evident in the neck and liver.

Dilatation of the heart, hæmic bruits, pulsations in the veins of the neck, are all evidence of lowered tonicity, and are indications for the exhibition of some drug which will improve that function. General tonic treatment will, of course, tend to this end, as is well seen in cases of anæmia, in which one frequently has seen the large venous pulse disappear as the general condition improves. But the drugs which affect tonicity beneficially, *par excellence*, are those of the digitalis group, and, of that group, squills and digitalis more especially. These indications for treatment hold to a great extent irrespective of the variety of the valvular lesion. Whether valvular disease is present or no, signs of lowered tonicity of the cardiac fibres ought to be met, in most instances, by the exhibition of some member of the digitalis group.

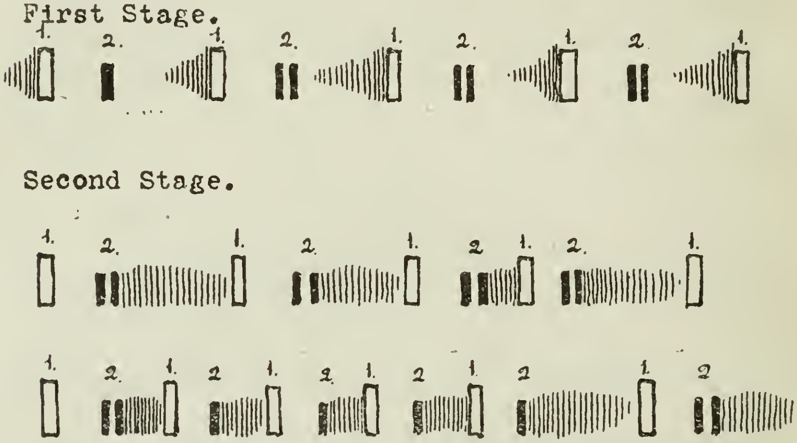
Another important effect of this group is to render systole more effective ; the actual contraction of the ventricle is more vigorous, and the diastolic dilatation less pronounced. The ventricles are more efficiently emptied. Any heart case, in which the systole is weak and inefficient, in which the blood tends to accumulate in the veins, will be benefited by these drugs.

Regurgitation through the auriculo-ventricular orifices will be diminished by the increased tone of the muscular fibres of the auriculo-ventricular openings, the ventricles will be more completely emptied, the blood-pressure will rise, and the heart itself will be more fully flushed with blood through the coronaries. It will, therefore, get a chance to hypertrophy, and so be more able to meet the extra demands on its strength.

Depression of the function of tonicity, and an inefficient and weak systole, are both indications for the administration of the digitalis group.

We have already noted that one of the actions of this group is to slow the heart. I have found this action to be most uncertain. There are a few points to be noted in this connection which are of interest, and a knowledge of which may guide us in our treatment.

In all orthodox descriptions of cases of mitral stenosis, two stages at least are described: the first in which the heart lesion is compensated and the pulse is regular, and in which, on auscultation, one hears a presystolic murmur; the second, or stage of failure, in which the pulse is no longer regular, except occasionally when the heart is beating with much increased frequency, and in which the rough grating, or purring, presystolic murmur has disappeared, and given place to an early, or mid diastolic bruit, or a murmur, which, while filling the whole of the period of diastole, is lacking in any presystolic accentuation (Fig. 1). Broadbent, Gibson, and Osler all look upon this second stage as denoting advanced stenosis with failing compensation. I do not believe that such an inference is entirely correct.


First Stage.

Second Stage.

Fig. 1.—*Diagram representing the heart sounds and murmurs present in the two "stages" or "types" of mitral stenosis. In the "first stage" the cardiac rhythm is regular, the murmur is presystolic, running up to a loud first sound, the second sound is frequently reduplicated. In the "second stage" note the cardiac arrhythmia, which is persistent; there is no presystolic accentuation of the murmur, the second sound may be reduplicated and is frequently almost inaudible.*

1. *Indicates the first sound.* 2. *Indicates the second sound.*

There can, of course, be no doubt as to the existence of two stages or types ; the one, in which the pulse is regular ; the other, in which the pulse is irregular, but the irregularity is due to causes other than failure of compensation, and is in no sense an accurate guide either to the extent of the stenosis or to the degree of cardiac failure.

Patients in this so-called "first stage" of mitral stenosis may die from progressive cardiac failure, with œdema, orthopnœa, and palpitation, and throughout the heart's action remains regular. On the other hand, arrhythmia may be present with fair compensation. Mackenzie has pointed out that what has really happened in these cases of mitral stenosis with cardiac arrhythmia is that the heart has changed the manner of its contraction.

Normally, the contraction of the heart begins in that portion of the auricle into which the large veins open, and it passes as a wave rapidly over the auricles, and then, viâ the auriculo-ventricular bundle, into the ventricles. Such is the normal sequence ; in which the auricular systole precedes the ventricular. A time comes in the history of some of the cases when this sequence ceases, and, on analysing the mode of the heart's action, one finds that the auricles and the ventricles are contracting simultaneously.

For the stimuli, which cause the heart to contract, instead of starting at the junction of the veins with the auricles, now start in the nodal portion of the auriculo-ventricular bundle, and spread simultaneously up into the auricles and down into the ventricles. The muscle fibres at this junction serve up the stimuli to which the rest of the heart muscle responds, and the rhythm may be termed "nodal."

It is important to note that the second stage does not of necessity indicate a very severe stenosis. It may appear long before the stenosis is advanced, or, on the contrary, it may be delayed, or perhaps never be reached, in cases with an extreme grade of stenosis. However, when the second stage is reached, the character of the case, as a heart case, is altered not only in the physical signs, but also in its response to treatment, and this is a point to which I particularly wish to refer.

Patients in this second stage of mitral stenosis are much more sensitive to the slowing action of the digitalis group than those in the first, and it is possible to predict, with greater certainty, the manner in which these drugs will act. In such patients, on the exhibition of any member of the digitalis group, the heart is slowed, sometimes markedly so, and there is a tendency for the cardiac rhythm to be that of a series of coupled beats, the first of which alone, in many instances, is of sufficient strength to send a pulse wave to the wrist. (*See* Fig. 2.)

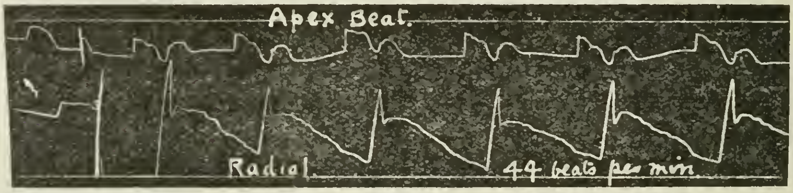


Fig. 2.—*Tracing taken from a patient with mitral stenosis in the "second stage," under the influence of strophanthus. Shows the coupled heart beats. The number of ventricular systoles was double the pulse rate.*

In contradistinction to this, I find that a case of mitral stenosis in the first stage, with a normal manner of systole, and a frequent action of the heart generally fails entirely to slow down under digitalis and its allies.

During 1906, I have had several such patients on digitalis and other drugs, and the following charts represent the variations in pulse rate resulting from treatment.

I will not enter into the details but briefly state the results. In one case of mitral stenosis, in the first stage, there was persistent and troublesome palpitation with severe palpitation; the pulse, on admission, was 100 per minute, regular in time and force; this rate had persisted for weeks anterior to coming into hospital.

Rest in bed brought the pulse rate down to 70, but any movement caused dyspnœa; some weeks later, owing to slight exertion, she experienced a severe attack of cardiac pain with hyperæsthesia all down the left side. Rest and bromides failed to touch the frequency: tinct. of squills, ♏xv., and potassium bromide, gr. x., t.i.d., had only a slight and transient effect; in fact, the frequency increased under the treatment of squills, which was given in large doses of xxv. minims of the tincture

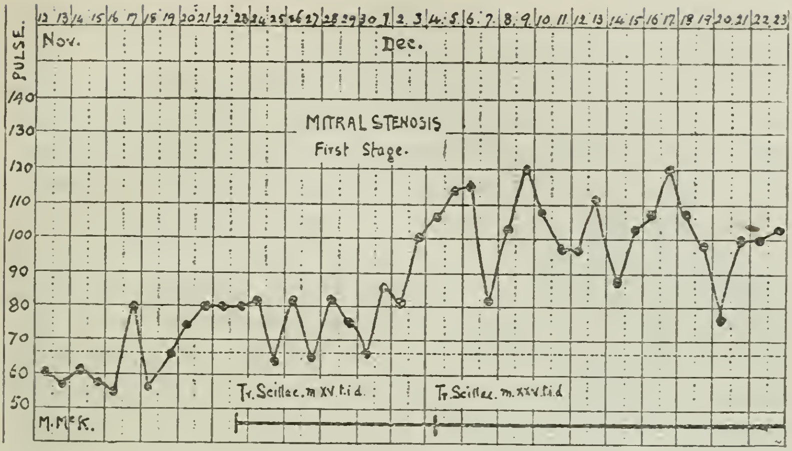


Fig. 3.—*Chart recording the number of heart beats per minute. The patient suffered from severe mitral stenosis in the "first stage." Her heart refused to be slowed by large doses of squills, digitalis, or strophanthus.*[1]

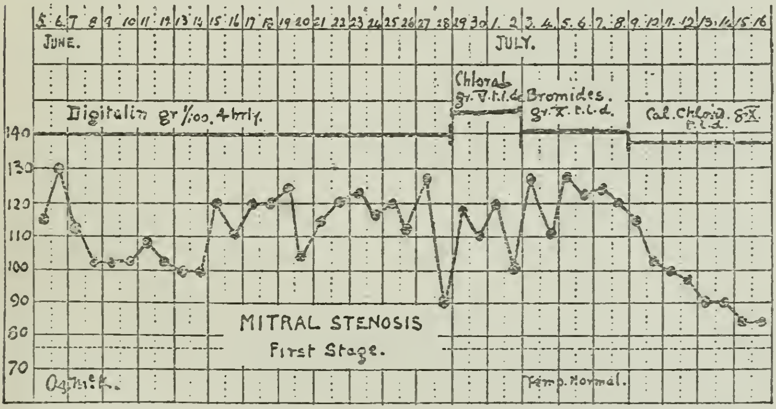


Fig. 4.—*Chart recording the number of heart-beats per minute in a patient suffering from severe mitral stenosis, in the "first stage." Rest in bed, digitalis, chloral, bromides, all failed to reduce the heart's frequency. Calcium chloride appeared to steady the action of the heart for a time.*

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[1] This patient died of cardiac failure on July 17, 1907. Through the courtesy of Dr. John Owen I had an opportunity of seeing the heart. There was extreme stenosis of the mitral orifice and slight contraction of the tricuspid opening. Up to the time of her death she remained in the "first stage" with a frequent and regular heart action. She became œdematous, and suffered from great dyspnoea and palpitation. Here we have death from cardiac failure in the absence of arrhythmia and the persistence of the so-called "first stage.

thrice daily. In spite of this, the pulse rate remained between 80 and 120. (*See* Fig. 3.)

A second patient, in the first stage of mitral stenosis, reacted similarly. Her pulse, which was regular, varied from 70 to 120; this frequency was unaffected by digitalis, by chloral, by bromides. It, however, responded to calcium chloride, which seemed to have a steadying effect. (*See* Fig. 4.)

Another patient, F. H., a girl of 15, who suffered from mitral stenosis in its first stage and slight aortic regurgitation, had a persistently frequent regular pulse, 100 to 120 beats per minute. She also suffered from marked palpitation and some dyspnœa. Digitalis and complete rest in bed had practically no effect on the frequency. The temperature was normal and in no way responsible for the frequent heart action.

Compare these three cases with two others, in which the heart was beating in the abnormal manner already described. The difference is marked and obvious. In one (*see* Fig. 5),

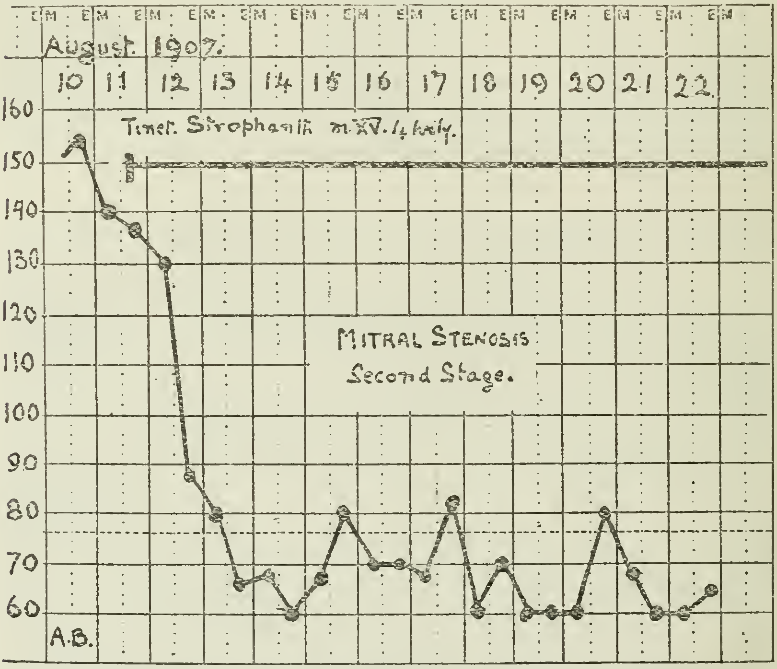
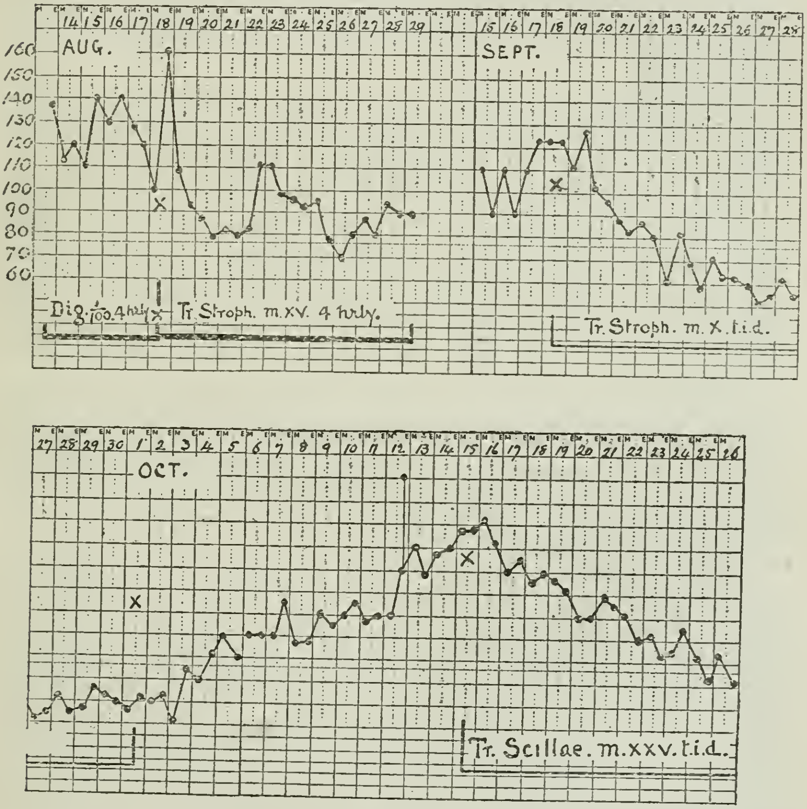


Fig. 5.—*Chart recording the number of heart-beats per minute in a patient suffering from mitral stenosis of the "second stage," showing an immediate response to strophanthus. This woman has been under observation for three years and a similar reaction to treatment noted many times. The date is incorrect. It should be August,* 1906.

the patient, A. B., a woman 50 years old, was admitted with a heart rate of 160; 15 minims of tinct. strophanthus, four hourly, slowed the heart, in two days, down to 60 beats per minute, and produced that peculiar doubling of ventricular systole in which only the first systole is strong enough to send a pulse to the wrist. Fig. 2 is taken from this patient.

In the next case (*see* Figs. 6 and 7), that of a woman,



Figs. 6 and 7.—*Charts recording the number of heart-beats per minute in a case of advanced mitral stenosis of the "second stage." The charts show the response to strophanthus on two occasions, August* 18, 1906, *and September* 18, 1906. *The steady rise of the heart rate is seen following the cessation of the strophanthus. The frequent action is then controlled by adequate doses of squills.*

aged 36, suffering from mitral stenosis in the second stage, the rate of the heart varied in the most interesting manner.

On admission, it ranged from 100 to 140. Digitalis and rest had a slight steadying influence, whereas strophanthus xv. min., six hourly, brought the frequency suddenly down from 160 to 80, and the woman could lie down in bed, which had not been possible before. Ten days afterwards, the heart ran up to 110–120, as the result of a sub-acute attack of rheumatism. Some weeks later, it responded again to strophanthus in x. min. doses, the heart frequency having crept up from about 60, at the time the strophanthus was stopped, to 140 per minute.

At another time, squills in xxv. min. doses, thrice daily, steadily pulled the heart frequency down to normal, and caused the heart to take on the significant doubling of its beat.

These cases prove that, in the second stage of mitral stenosis, the frequency of the heart's action is very much more sensitive to digitalis, strophanthus, and squills than in the first stage; and they also demonstrate the power of all these three drugs to produce the characteristic coupling of the beats.

If, however, in an early mitral stenosis, or, in fact, in any mitral case, there are signs which point to a depression of tonicity, or, if the ventricle contracts and dilates ineffectually, then the digitalis group will be of the greatest value, irrespective of its effect on the pulse rate.

It is a noticeable fact that quite a number of the patients, suffering from mitral stenosis in the first stage, have a frequent heart-beat associated with some sense of dyspnœa and distress. Digitalis usually fails to relieve them, strophanthus likewise fails. I get, as a matter of fact, the greatest benefit from absolute rest in bed, and the administration of salines and general tonics. Small doses of liquor trinitrine and belladonna, as recommended by Sir James Barr, are of service. Massage is sometimes useful.

In searching for the indications for treatment in cases of heart disease or heart failure, there is one instrument which is of very considerable assistance. I refer to the hæmodynamometer. In certain cases it is of service, when considering the question of the exhibition of the digitalis group.

I refer to those patients in whom the heart suddenly fails, and in whom the pulse frequency runs up to 150 or 160.

Dyspnœa is present, and perhaps a little œdema of the ankles. The apex beat is outside the nipple line, and is slapping and forcible; possibly there is a systolic bruit audible over the mitral area.

The radial artery is contracted down on its contents, and does not give to the fingers the sensation of increased blood pressure, but the hæmodynamometer demonstrates that the pressure is high, possibly 180 to 200 mm. Hg. The case is one of latent chronic nephritis with a heart struggling against the abnormal blood pressure. The dyspnœa is due partly to the heart stress, and partly to the uræmia. In such patients, the exhibition of digitalis often increases the distress, and I have seen marked relief on stopping its administration. I find that the best treatment is purgation with calomel and salines, stopping all food except some water, tea, and a little bread and butter, and the administration of such drugs as the benzoates, or hippurates of ammonium, together with the infusion of buchu. Strophanthus, or citrate of caffeine, may be given, as these drugs do not contract up the arterioles. For the restlessness and dyspnœa in such patients, chloral, in my experience, is of the greatest benefit, and can be prescribed with caffeine if thought advisable.

In the matter of dosage, I am convinced that the tendency is to be satisfied with the administration of too small doses of digitalis and squills, and firmly believe that, when we are satisfied in a particular case that digitalis is the best drug to be given, we must push it until we get the result we are aiming at, or until we get signs of its physiological action. It may be objected that, in so doing, we are running risks: that is so; but the risks are justifiable.

When the case is urgent, I believe in giving either one or two very large doses of the tinct. of digitalis, or a few preliminary doses of tinct. of strophanthus, xv. mm., every other hour for a few hours, combined with a similar dose of digitalis or squills; after the first few doses the digitalis, or squills, to be given alone. The strophanthus acts much more rapidly than the digitalis, the action of the latter becoming apparent in a day or two.

Dr. George Balfour, in his charming book on "The Senile Heart," lays stress on that most important point in the treatment of the weakened heart muscle in the aged, namely, the necessity for combining some vasodilator with the digitalis. Potassium iodide, the nitrites, ammonium hippurate, may all be used in this rôle with advantage. In senile cases he strongly advises small doses of digitalis, continued for months, so that the nutrition of the myocardium is slowly improved, while there is no extra stress placed on the heart, owing to the vasodilation produced by the iodides, nitrites, or hippurates.

Before concluding, there are one or two drugs to which I would like to refer, while discussing cardiac therapeutics. The first of these is morphia, a drug which is almost invaluable in the treatment of heart disease. In certain cases of rapid heart action, morphia is sometimes successful in steadying the heart when everything else has failed. It is also of recognised value in the treatment of dyspnœa, and this is the easier to understand, when one appreciates the fact that dyspnœa is largely subjective, and that the severity of the dyspnœa holds no direct relationship to the frequency of the respirations, or the frequency of the heart beat.

It is well to bear in mind that dyspnœa in heart disease is found associated with two entirely different phases of arterial blood-pressure. In both morphia is useful. In the one, you find the pressure at or below the normal; in these patients the heart mischief is primarily valvular, defects such as mitral regurgitation or stenosis being present.

The dyspnœa, in those cases in which there is muscle failure, is most distressing, and the patient's nights are continuously broken, short snatches of sleep ending in a sudden start, and an attack of difficult breathing. For such patients, morphia should be combined with digitalin, or digitalin and atropine, in order, if possible, to tone up the failing heart muscle, and, at the same time, to relieve the subjective sensations of dyspnœa.

The other phase of heart case, characterised by dyspnœa, I have already alluded to. In it the blood pressure is high, probably over 200 mm. Hg., and the pulse is usually regular but not invariably so. For these patients, the morphia should be combined with some vaso-dilator given either by the mouth or hypodermically. Liquor trinitrini, nitrite of sodium, ammonium hippurate can be used for this purpose.

Our well-tried friends, the blue pill and the seidlitz powder, are more valuable than most drugs, in lowering the general blood pressure, by depleting the splanchnic area. The blue pill has also a very beneficial effect on the insomnia, when such is present. This second type of case is found in patients suffering from chronic interstitial nephritis, in whom the dyspnœa and apparent cardiac distress may be the first indications of the disease which until then has been latent.

The sudden myocardial insufficiency in cases of latent Bright's may have influenza as the exciting factor. I saw such a case some months ago. The patient suddenly collapsed during her convalescence from a moderately severe attack of influenza. Her doctor told me that her pulse almost disappeared, her skin became cold, grey, and clammy, and she appeared to be dying. Under strong stimulating treatment, her heart recovered itself, and when I saw her the next day her blood pressure was over 220 mm. Hg. In this case, the wisdom of lowering the blood pressure and easing the heart, until it entirely recovered its tone, is obvious.

In patients suffering from chronic nephritis with cardiac distress, it is often difficult to estimate how far the dyspnœa is uræmic, and how far caused by the heart stress.

However, so far as treatment by opium is concerned, it really does not materially matter, because, in either case, morphia is safe and acceptable. The old bugbear of the dangers of injecting morphia in patients suffering from chronic nephritis is dead, for the kidneys have nothing to do with the excretion of morphia, and opium can be given with confidence when the symptoms demand it.

SOME COMPLICATIONS OF DIPHTHERIA.

By THEODORE FISHER, M.D., M.R.C.P.,
Assistant Physician to the East End Hospital for Children, Shadwell.

[With Plates XIII.—XIV.]

In dealing with a case of diphtheria, the possibility of the onset of cardiac failure, paralysis of the diaphragm, suppression of urine, bronchopneumonia, nervous sequelæ, and various other serious complications are, it is needless to say, ever before the mind. There are, however, a few complications which, although not, perhaps, of importance, are of sufficient interest to merit some notice.

One of these complications is enlargement of the liver. In cases, in which death has been due to diphtheria, a large liver is frequently seen in the post-mortem room. The first example, however, which especially attracted my attention was seen clinically. Through the courtesy of a medical colleague, I had an opportunity of seeing a case where enlargement of the liver of obscure nature was present in a boy of about five years of age. A triple sound of *bruit de galop* character was audible over the heart, and the question arose whether the sound did not indicate that the enlargement might be of cardiac origin. Later, it was ascertained that the boy had recently suffered from diphtheria, a fact which lent support to the view that the heart was mainly at fault, and responsible for the enlargement of the liver. All doubt upon the point seemed eventually to be set at rest by the return of the liver to a normal size, and the disappearance of the triple cardiac sounds after the boy had been a few weeks in bed. In this case, enlargement of the liver had attracted attention after recovery from diphtheria. This is possibly not a common occurrence, but, as has been already mentioned, in fatal cases of diphtheria an enlarged liver is frequently found after death.

In my possession, are abstracts of only a small percentage of the autopsies performed by myself upon cases of diphtheria. I cannot, therefore, give statistics of any value as to the frequency of enlargement of the liver. It may, however, be worthy of mention that in 26 cases of death from diphtheria the liver was definitely enlarged in 8, or in nearly one-third. Amongst these 8, in a girl, aged 3 years, "the liver was down to the umbilicus"; in a boy, aged 16 months, the weight of the liver was 21½ ounces; in a girl, aged 2 years, the weight of the liver was 23 ounces; in a boy, aged 2½ years, it weighed 25½ ounces; in a girl, aged 4 years, 38 ounces; and in a boy, aged 13 years, 50 ounces. When these weights are compared with the average normal weights of the liver in children, the enlargement will be obvious. At the age of 12 months the liver weighs about 11 ounces, and at the age of 3 years, 16 ounces. A diagram perhaps gives a better idea of the degree of enlargement of the liver than the mention of the weight. Fig. 1 is a copy of a rough sketch made at the time of the post-mortem examination on the child, aged 2 years, mentioned above, in which the liver weighed 23 ounces. The heart was much dilated, and measured 7 inches round the base of the ventricles. The liver may occasionally rapidly enlarge in children suffering from septicæmia, owing to the appearance of fat within the liver-cells. In the enlarged liver of diphtheria, however, the presence of fat does not seem to play an important part in the enlargement. The main feature seen on microscopical examination is general congestion, red blood-cells between the columns of liver-cells being greatly in excess of the normal, while the amount of fat is comparatively trifling. This marked congestion of the liver appears to indicate that the enlargement is dependent upon cardiac failure.

Another not uncommon morbid condition to be found in diphtheria, which, however, can only be recognised in the post-mortem room, is disease of the arterial vessels. Raised yellow patches may be seen in the aorta, or there may be nodules of considerable thickening in the smaller arteries; for example, in the arteries of the brain. The patches of thickening, which may be seen in the aorta in diphtheria, are not easy to illustrate by means of a photograph, but possibly the diseased area will be recognised in Fig. 2. The photograph is of a portion of the aorta and heart of a girl, aged 4 years, who had died of diphtheria.

It is not only where death has been due to diphtheria that areas of disease may be seen in the arteries of children. In other diseases of infective nature, such as enteric fever, or septicæmia, the patches may be seen. Dr. Oskar Klotz however, in a recent paper,[1] basing his conclusions upon experiments on animals, differentiates between the disease of the vessels, which is produced by the toxins of diphtheria, and that produced by the presence of micro-organisms in the blood. The injection of diphtheria toxins into animals, Dr. Klotz says, produces degeneration of the middle coat of arteries, which is unassociated with proliferative changes in the intima; while experimental injection with typhoid bacilli, or streptococci, leads to "warty thickenings" of the intima, the middle coat being only slightly affected. In children dying of diphtheria, small opaque yellow lines, or patches, may occasionally be seen without alteration in the level of the inner surface of the aorta. Possibly these small spots indicate the presence of very localised degenerative changes in the media. But, allowing that they indicate disease of the media, patches of raised thickening of the intima are more common, and this being so, if we accept the experiments of Dr. Klotz as explaining the ætiology of these patches, we must suppose that the disease of the aorta is due, not to diphtheria toxins, but to the presence of associated septic micro-organisms in the blood.

In connection with disease of the aorta, it should perhaps be mentioned that sometimes a small patch of yellow thickening may be seen at the base of the large flap of the mitral valve, immediately below the contiguous aortic valve-segments. Later this patch may become calcified, but it is never sufficiently large to interfere with the action of the valve. It may be added that I have seen such a patch in the mitral valve as early as the age of 22 months.

To the left of the aorta in Fig 2 is the appendix of the right auricle which has been cut across. The section exposes an ante-mortem thrombus. Like disease of the aorta, thrombosis, in one or more cavities of the heart, may be occasionally seen in any disease in which micro-organisms are present in the blood; yet it is not a common complication of diphtheria. In the case, from which this photograph was taken, thrombosis, however, was not only present in the heart, but also in the left renal vein, and the resulting congestion had caused the left kidney to swell to twice the size of its fellow on the opposite

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[1] *Brit. Med. Journ.*, December 22, 1906, p. 1767.

PLATE XIII.

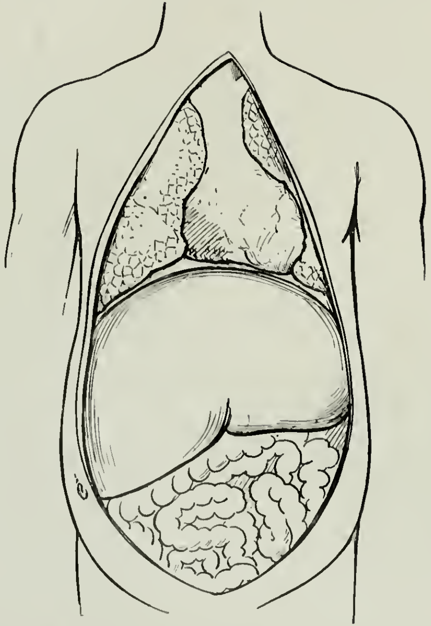

Fig. 1.—*Enlargement of the liver in a case of death from diphtheria.*

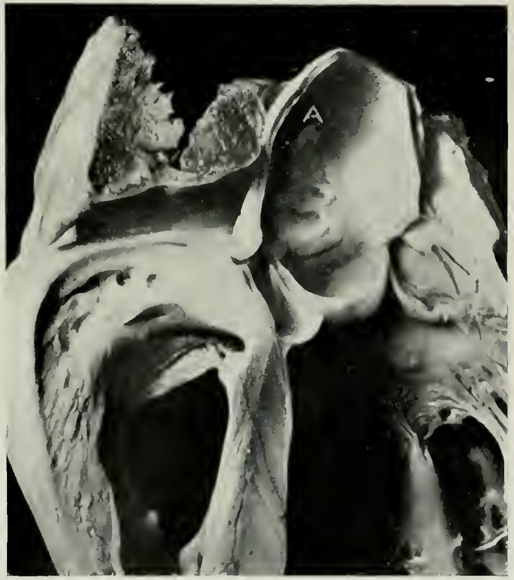

Fig. 2.—*Disease of the aorta in diphtheria. The letter* A *is situated above the upper limit of the patch of disease. To the left of the aorta is the appendix of the right auricle cut across. It contains thrombus.*

PLATE XIV.

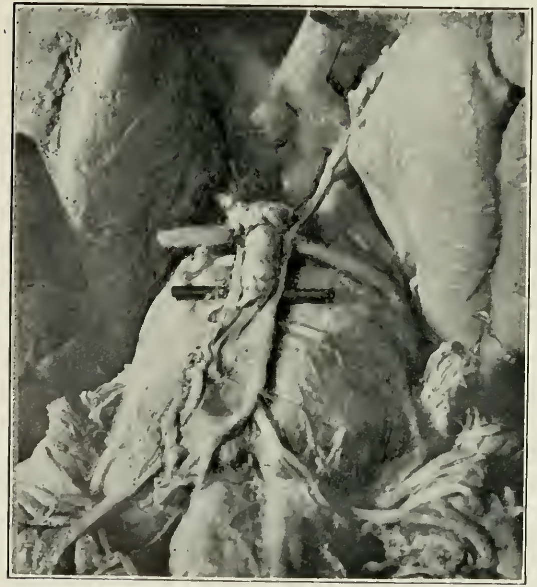

Fig. 3.—*Thrombosis of the basilar artery in diphtheria. A glass rod passed beneath the opened artery marks the position of the thrombus.*

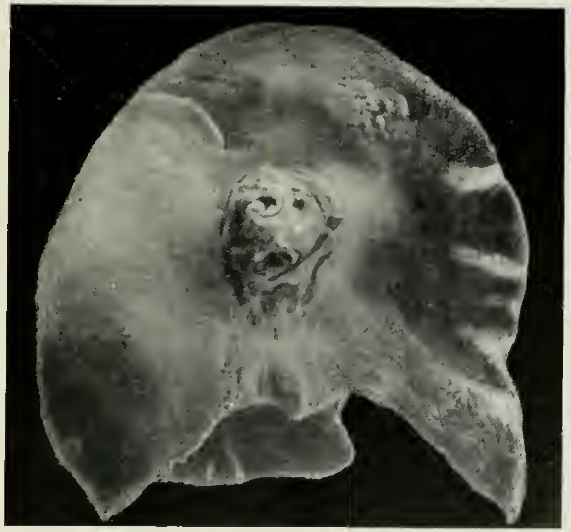

Fig. 4.—*Interlobular emphysema in diphtheria. The pale areas running inwards from the anterior border of the lung are due to the presence of air outside the alveoli in the interstitial structure of the lung.*

side. In connection with thrombosis within the cavities of the heart, it may be mentioned that Marfan has recorded a case, in which a thrombus in the left auricle of the heart, occurring in diphtheria, became detached, and caused embolism of the abdominal aorta. In diphtheria, however, any serious consequence of thrombosis, such as embolus, or the presence of the clotting in an important vessel, would appear to be rare. Yet I have made an autopsy on a case in which thrombosis occurred in the basilar artery. The case, to which I refer, has been recorded by Dr. Edgeworth.[1] A boy, aged 9 months, was seized, on the 24th day after the onset of a diphtheritic sore throat, with opisthotonos of so severe a character that there were only 9 inches between the occiput and the sacrum. He died about twelve hours later. At the autopsy, a thrombus was found in the anterior third of the basilar artery. An illustration of which is given (Fig. 3). It should be mentioned that, although I have seen the wall of the basilar artery present nodules of thickening in diphtheria, in this case there was no local disease of the vessel. There was also no evidence that the thrombosis had formed around a small embolus; at least, no ante-mortem thrombosis could be found in the left auricle or elsewhere from which an embolus could have originated.

Of different character from the complications described above, but like the majority of them rarely adding to the danger of diphtheria to life, is interlobular emphysema. The obstruction in the larynx in diphtheria very frequently causes air, which has escaped from the alveoli of the lung, to appear beneath the pleura. The escaped air generally remains localised to a few small areas, but it may find its way to the mediastinum and from there to the subcutaneous tissues of the neck and chest, or perhaps it may earlier burst into a pleural cavity and produce pneumothorax, of which accident many cases have been recorded. I have, however, never seen pneumothorax, produced in the lung or the air, extend beyond the mediastinum, but in this situation, more than once, the interstitial tissue, lying in front of and above the pericardium, has presented a remarkable appearance, being distended by a mass of bubbles of various sizes, which filled the space between the upper margin of the sternum and the diaphragm. Fig. 4, from a photograph of the left lung of a child, aged 4 years, which had died of diphtheria, shows several wedges of air separating areas of lung tissue along the anterior border of the lung. There are also a few bubbles on the inner surface.

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[1] *Lancet*, June 10, 1899.

Another complication, occurring in connection with disease of the lung, may be worthy of mention. In a female child, aged 5 years, which had died of diphtheria, two patches of gangrene, situated at the base of the left lung, were associated with, and were possibly in some way responsible for, clubbing of the fingers of both hands. The chief feature of interest did not lie, however, in the presence of the clubbing of the fingers, but in its rapid development. It was said to have appeared within six days. The truth of this may possibly be doubted, but Dr. Samuel West has recorded two instances of similar rapid onset. In one case, a gentleman, suffering from right-sided empyema, was seen by Dr. West. Fourteen days later he was again seen, and during the interval the fingers had become "markedly, in fact extremely clubbed." Dr. West adds: "The time which the clubbing had taken to develop was certainly not more than a fortnight at the outside, but it may have been much less."[1]

It is needless to say that none of the complications referred to are peculiar to diphtheria. Enlargement of the liver appears, however, to be connected with a complication of diphtheria—namely, cardiac failure—which is so frequent as almost to be worthy of being considered a special feature of the disease. In the majority of cases of enlargement of the liver arising during acute disease in children, the enlargement is due to the presence of fat in the liver cells. In diphtheria, however, in spite of the liability of various organs to fatty changes, the enlargement of the liver is due mainly, not to the presence of fat, but to distension of capillaries of the liver with blood, and in this detail, therefore, this complication may be said to possess distinctive features.

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[1] *Clin. Society Transactions*, Vol. XXX., p. 60.

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THE TREATMENT OF MICROBIC INVASIONS BY BIER'S HYPERÆMIA.*

By ALEX. MacLENNAN, M.B., C.M.,

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In a recent Rectorial address at Aberdeen, Sir Frederick Treves gave utterance to views which were considered to be striking. According to this authority disease was beneficial. Inflammation very aptly illustrates his meaning; for it is not a disease but the evidence of Nature's fight against it. The disease is the microbe. This view of the subject, which is advocated by Professor Bier of Bonn, has caused, or perhaps more strictly speaking is causing, a revolution in the treatment of those conditions which present the signs of inflammation. The title of his book[1] is "Hyperämie als Heilmittel." That part of the work which deals with hot-air treatment, I will omit at present, though, according to Bier, hot-air hyperæmia is a more arterial one, and more suitable for non-parasitic diseases. The work was recently reviewed, somewhat inadequately I think, in the *British Medical Journal.*[2]

To begin with, the correct rendering of the word *Stauung*, as denoting a particular kind of hyperæmia, is the first difficulty, but I would suggest that the word should be taken over by us and incorporated in our vocabulary. Some kind of explanation will always be necessary in order to indicate the meaning of a new word, and I would suggest that "obstruction" expresses the idea of *Stauung* pretty accurately. *Stauungshyperämie* may therefore be translated "obstruction hyperæmia." The method employed to produce *Stauungshyperämie* consists briefly in the application of a light Martin's elastic bandage, 6 c.ms. broad proximal to the seat of inflammation, and as remote from it as convenient, though in no case must the pressure be applied on the affected area. The degree of tightness of application is the important feature of the treatment, and it is impossible to give adequate directions, as those of necessity vary to such an extent. Roughly, however, the return flow of blood has only to be impeded, the pulse has not to be affected, nor has the temperature of the limb to be lowered. The colour of the inflamed region is intensified, the skin becoming uniformly a brilliant red, not spotty. Further than this, the best guide as to the proper application will be obtained by consulting the patient's comfort, for the degree of tension, which is most comfortable for the patient, is also the most correct in the matter of treatment. There is, however, only one degree of tightness which is ideally correct. It must vary on different cases, with different limbs, and at different times on the same limb. Changes in position naturally alter the blood pressure, and what may be right in the erect posture may be too tight in the recumbent. In mild and chronic cases the patients do not require to be kept in bed. The effects of the bandage may be observed for an hour, thereafter the patient may be allowed to go home. No harm can follow from excessive tightness during this hour of probation. This plan, which I have adopted for a considerable time, is also recommended by Bonnheim[3] who has treated 300 cases with almost uniform success. That mistakes will arise, I might instance a case under my own care. A girl, of 14, had a mastoid abscess opened one day, and the bandage was to be worn round her neck, but only at night. She was to return two days later for the radical operation. This was repeatedly explained to both mother and child, but the mother insisted upon the child retaining the band round her neck continuously. When she came back for the major operation, the face was somewhat œdematous, but the condition of the mastoid was entirely satisfactory. There is little danger of a bandage being put round the neck too tightly, for any excess of tension soon becomes unbearable.

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* Read at a meeting of the Glasgow Medico-Chirurgical Society.

The bandage obstructs the venous flow so as to cause the part distally to retain more fluid than formerly, and when a certain volume, with a corresponding pressure, is reached, the incoming and outgoing currents are equal. The obstruction to the lymphatic return must not be too evident, otherwise the type of hyperæmia produced is designated by Bier as "white" which he states to be harmful.

The changes brought about by the procedure, for instance, in an inflamed limb, are what appear to be an aggravation of the lesion. The redness is markedly increased, it becomes more fiery, and the swelling is more evident. This action is continued in acute cases for 22 hours. There is then an interval employed in reducing the œdema by elevating the part, assisted if necessary by massage. The curative forces of inflammation are reinforced, and the beneficent effects are more evident. That such a manœuvre should be productive of good is eminently rational and logical; further it is corroborated by experiment and borne out by practice. It is striking testimony to its practical value, that Bier has doubled the clinique at Bonn, while, during the same time, the number of operations has been fewer. Pain is relieved, the temperature tends to fall, the general state of the patient is rendered more comfortable, the course of the disease is shortened, the tendency for pus to form is reduced, and the possibility of gangrene occurring lessened. All these effects are relative, and it is distinctly pointed out by Bier that there are cases which defy all methods of treatment.

Everyone, with experience of sepsis, must be familiar with the slow action of antiseptics in most cases, and, in some, of the apparently increased tendency of the tissues to slough, yet it is an admitted fact, by all who have tried *stauung*, that tendons in septic synovitis, so treated, have a much better chance of surviving than when the septic infection is treated by free incision, and antiseptics.

In all the severe septic synovitis cases, which I have observed, I have only seen the tendons survive in one, and that one was treated like the others, but with the addition of *stauung*.

It is and has been in full swing at the Western Dispensary for a number of months past. I have to thank the residents for carrying out the treatment and for furnishing me with a number of reports of cases. I would most strongly recommend it as eminently suitable for private practice.

Some papers suggest the advantage of sending cases for proper treatment to the author, but this paper is to show how the general practitioner may treat his own cases. I know that this suggestion that the practitioner should treat his own cases, and can do so without risk, is not accepted by all writers, but the application of an elastic bandage is no more likely to be wrongly used than are antiseptics, incisions, etc.

How the action of *stauungs* hyperæmia may be explained in current scientific terms is no easy matter. Lately the opsonic index[4] has been found to be raised by the application of the elastic bandage, and two workers have supposed that this explains the rationale of Bier's treatment, but there is a great deal more in the method than that. One feature of the opsonin teaching, which, so far I have not seen touched upon, is the fact that no notice is taken of the fate of the phagocytes after ingesting the microbes. The index measures the appetite of the cells, but not their digestive powers. It is the latter which is of vital importance. A phagocyte, which bites off more than it can chew, or whose eyes are worse to fill than its belly, is a calamity for its host, as it will be a means of carrying the safely packed microbes to distant parts of the body. Baumgarten[5] considers the effect of congestion to be such as to reduce the nidus upon which the microbe thrives, and so to bring about what he terms a "hunger death" for the invading germ.

I would rather account for the mode of action by assuming that the increased serum supply, from which the living cells as well as their appetisers receive their nourishment, makes them more capable of destroying the invading organisms. There can be no doubt that congestion causes improvement in nutrition. There is increase in epithelial growth evidenced by the growth of hair. Bier refers to cases of real hypertrophy of muscle, consequent upon venous thrombosis, as a complication of enteric fever. Lately I saw a man at my dispensary at the Western Infirmary, who, after enteric, developed an enormous hypertrophy of both legs, the calf measurements being 18½ and 17½ inches respectively. This hypertrophy was neither œdematous nor fatty, but muscular. If *stauung* improves nutrition, it is therefore suitable in the treatment of cases suffering from indifferent nutrition, for example, non-union in fractures, etc.

It has been said that the *stauung* treatment may be productive of harmful results. Does the method then really have any serious drawbacks?

1. Discomfort, or perhaps pain, may be complained of at

the seat of pressure, as some limbs are more sensitive, or some people less patient, than others. The bandage ought therefore to be altered in its position from time to time in such cases, and in all, if possible, the site chosen for constricting varied at each application. The bandage ought also to be spread over a fair section of the limb.

2. Increase in pain at the seat of infection may be complained of. In this case it is usually the result of over-tightness, though there are some cases in which the pain is increased upon the slightest tension of the bandage. The pain usually subsides within an hour; if it does not, it is probable that such cases are unsuitable for the treatment.

3. Increase in the evil effects of the infection, such as broadening of the affected area with spreading of gangrene, or magnification of the abscess, are all probably due to the excessive tightness of the bandage, or the virulence of the microbe is alone responsible for the severity of the lesions.

4. Erysipelas, or a diffuse spreading inflammation of the skin, is the commonest complication which is attributed to the *stauung*, but how often does such an untoward result occur in cases treated by other methods?

5. Where, in a recent wound, a tendency exists for bleeding to continue, the application of the bandage must be delayed.

6. An increase in the tendency to dissemination, or generalisation, of the infection has been attributed to this treatment, and as erysipelas may complicate the course of the disease, so also, and for the same reason, may generalisation take place. Whatever treatment improves the local condition will also materially diminish the risk of the disease becoming disseminated.

7. During the interval in the *stauung*, the patients are ill, and the temperature tends to rise on account of the increased absorption. Lexer[6] draws attention to this point, and it may be relevant to quote his remarks.

(*a*) The alteration in absorption in mild cases does no harm, but in severe cases it requires efficient incisions in order to prevent the accumulation, which has resulted from the *stauung*, from injuring the patient when the *stauung* is removed.

(*b*) The increase in the protective bodies, consequent on the *stauung,* is, so far as concerns antitoxins, without actual importance, relative to bactericidal bodies is advantageous, but, in severe cases, harmful through the freeing of a large amount of endotoxine—the result of bacteriolysis. Only long and prompt incisions into the tissues obviate this damage.

(*c*) The increase in the proteolytic ferments from the *stauung* acts favourably in infected wounds and in operation wounds. On the contrary the liquefaction of the inflammatory exudate, where it does not occur in a negligible quantity, must be prevented by prompt section, otherwise necrosis of important tissues is accentuated, or the pus infiltrates into surrounding regions.

(*d*) The increase in the transudate, especially the exudate during *stauung,* acts harmfully in closed or inadequately drained infective centres, as a result of the dissemination of the toxines through the tissues, notably, however, it acts in operation and accidental wounds as a mechanical cleanser, of the infective materials. To sum up, Lexer recommends *stauung* to be employed only in mild cases, and to treat severe ones by incisions (cases are considered severe in which a distinct exacerbation follows *stauung*). This virtually means that the method may be applied till it becomes evident that the case is not a suitable one for it.

Before passing on to the modifications in the procedure, I would draw attention to one or two points.

1. Do not apply the bandage too tightly. The production of blisters over the infected area is evidence of this fault. Change the bandage after ten hours or so to a different place, as any discomfort occasioned, after an hour, is local from pressure on nerves. To avoid this in certain situations the bandage is recommended to be placed over a layer of gamgee.

2. Gain some experience in its procedure and action before treating the severer forms of sepsis, such as arthritis, osteomyelitis, etc. In such cases, *stauung* is infinitely less dangerous than the only too frequent temporising with the poultice.

3. Take the patient's feelings into consideration, and carry them with you in your line of treatment.

4. Combine it with other already proved and better known methods. In all cases, remember that it is not a substitute

for every other remedy, for the old maxim remains, "*ubi pus ibi evacua.*"

5. All dressings must be merely laid on and not tightly bandaged when the part is being congested.

6. Antiseptics may be used during the intervals, and dry dressing should be employed.

7. Sufficient time is to be allowed for the excess of œdema to dissipate.

8. Gentle massage (painless) may be employed remote from the disease. (Massage has been recommended as a means of treatment to be applied even to the inflamed area.)

Besides producing congestion by a proximal bandage, a similar result is achieved by placing the limb, or a part of it, in a partial vacuum. Instead of obstructing the venous return, the return flow is induced to remain by withdrawal of atmospheric pressure. The effects are similar, but come on more rapidly, they are more effective, and are more easily controlled. In the *stauung* variety, the congestion is fiery red; that from suction is more cyanotic. It has been found by experience that certain cases are more suitably treated by this means, and it is the method *par excellence* for localised inflammation. The one drawback to its use is that personal attention, involving much time, must be given to the application till the patient is educated to the requirements of the treatment.

It has been said that there is nothing new in this principle, that it is as old as the race, and perhaps older, for animals instinctively suck and lick their wounds. What is new is that such suction does not cure by the amount which is extracted from the wound, but rather by the amount of blood attracted to the neighbourhood of the wound. It is not cupping, but the intelligent scientific application of hyperæmia which is beneficial, in addition to the extraction of fluid, or the production of discharge.

The surface is prepared for incision in the usual way, then smeared over with sterile vaseline (to prevent the discharge from inoculating the clean surface, and to ensure tight fitting of the glass), and the abscess is opened by puncture. After cessation of bleeding, the suction apparatus is applied so as to distinctly congest the region without causing pain; a profuse discharge is produced. The suction is continued for an hour with intervals of three minutes every five. The usual dressing is then applied, and next day the same procedure repeated. In some cases, it is advisable to shorten the *séances*, and to have two sittings daily. If the puncture has then closed, it is picked open before re-applying suction. After a few applications, the intelligent patient becomes a skilled operator, and knows to a grain how much of the atmospheric pressure to reduce, by the ball or pump, so as to get the most relief. After a time, the treatment is carried out every second day, till a cure has been effected. It is to be here noted that drainage tubes are dispensed with, and packing is on no account to be used. For tubercular sinuses, the suction may be more forcible than that employed in acute conditions.

The apparatus required to place an entire limb in a negative pressure is inconvenient and expensive, still this is always overcome, if the preservation of the limb, if not life, is concerned. Bier, in conjunction with his assistant, Professor Klapp, has elaborated and perfected such apparatus for head, knee, leg, elbow, forearm, fingers, and various parts of the body. I now show you various types of apparatus for the performance of this treatment, and I shall indicate the mode of application of each type. It is quite impossible in indicating the cases suitable for this treatment to do more than pick out typical instances to illustrate the principles involved ; when these are understood all manner of conditions may be found suitable and worked upon.

The cases, which are suitable for the production of congestion either by the bandage or suction, are very numerous. All critics are agreed that if the principle is good for anything, it will be good when it is prophylactically applied. Every presumably infected wound is suitable for the exhibition of the forces of inflammation before they are actually required. By this means, stitches, which would inevitably cut through, hold the edges of a wound in position, and even where a wound has broken down, and is already septic, in many cases, the use of the proximal bandage in addition to the insertion of fresh sutures will cause the edges to adhere. For this to occur, the destructive action of the infective process must be transmuted into a formative one of tissue repair. Compound fractures therefore supply just exactly the conditions, in which the *stauung* will be useful, and in practice this has been found to be the case.

The greatness of this step is evident, for one might say that, before repair takes place, the invading microbe must be destroyed or inhibited. I do not think anyone will say that it is no new thing to congest a compound fracture, or to stitch a purulent wound and so get it to heal.

Septic conditions about the head, including erysipelas, mastoiditis, scalp abscess, etc., are suitable cases for the treatment. Empyemata of the nasal accessory cavities have been successfully treated by the application of an elastic band round the neck, though it is stated that the septic process, when confined to a closed cavity, must not be treated by Bier's method. This development of the treatment may raise a smile, and cause some misgivings about a remedy which claims so wide an application. Probably, however, the old-fashioned treatment ot a cold by a wet compress round the neck, did not gain its reputation because of the moisture or the heat, but on account of the tightness with which the compress happened to be applied. I might go on *ad infinitum* about the various conditions which may be treated by congestion, but something may well be left to the imagination. In the foregoing part of the paper, the application of congestion to septic affections has been principally considered, but there still remains the important class of chronic ones. Many years ago, Bier brought in his treatment of tubercular joints by congestion which was kept up for weeks at a time. The origin of his idea he relates in his book. Since that time, Bier has worked at congestion, and his treatment for tuberculosis has been considerably modified. He has found that better results are brought about by congestion applied only for short periods. Thus, in his book, he recommends the elastic bandage to be applied for one hour daily as against the twenty-two recommended for acute affections. As a still further improvement, tubercular joints are treated in large suction apparatus. Thus there is the alternation of five minutes congestion with three minutes relief for a period of an hour every second day, and the results are claimed to be more satisfactory. The progress is slow but sustained. In the absence of large apparatus, these conditions may be treated as formerly with the elastic band. It is stated that softening is induced with the formation of abscess.[7] I think this is the case, but Bier does not admit that the prognosis is thereby the worse if the abscesses are treated by suction till closed. He also affirms that joints so treated regain their functional condition. As the treatment requires to be so long continued, it will take yet a considerable time before the question is finally settled.

To sum up the points in favour of this method is no easy task, not because the benefits are either few, or trivial, but because the method is suitable for so many diverse conditions, many of which react very slightly to all known remedies.

1. The treatment is agreeable to the patient.
2. The treatment is so because it relieves pain, or removes the necessity for painful procedures, such as packing an abscess cavity. It allows an earlier start to be made with passive and active movements.[8]
3. The treatment is admittedly beneficial when applied before infection becomes established. It is further most useful in all mild cases, or in severe but limited invasions, such, for instance, as in a boil.
4. It aids recovery, cutting short the necessity for inflammation by a considerable time. It permits of repair being carried out in the face of infection.
5. The reduction in the size of the incisions shows an improvement from the æsthetic point of view.[9]
6. It diminishes the number of operations, it is helpful in many cases for which there is no other treatment.

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THE TREATMENT OF SOME INFLAMMATORY CONDITIONS BY BIER'S METHOD.

By A. B. FLETT, M.B., Ch.B.

ILLUSTRATIVE CASES.

To many practitioners, the name of Bier is associated with a form of treatment applicable to certain cases of disease, mainly of tuberculous joints, the rationale of which treatment is not fully understood, and the use of which is purely empirical, and of limited value.

This is, however, far from being actually the case, the real worth of passive congestion, and its applicability to various forms of inflammatory disease, especially septic conditions, being very considerable, and the results attained by it in many cases being highly satisfactory, and in a certain proportion astonishing.

In penning the following lines, I would endeavour to impress the fact that, by adopting Bier's methods, a form of treatment, which proves useful in everyday practice, is being required, and which is not, as many suppose, limited to cases which are under constant observation, or treated in hospital.

In inflammatory conditions, one of the most striking results, following the adoption of passive congestion, is the rapid relief from pain which usually ensues, a matter most important from point of view alike of doctor and of patient.

In many cases, in which pain is intense, fifteen or twenty minutes is sufficient to transform the condition to one of comparative comfort.

This, though an important point, is but a secondary one. Under the benign influence of the artificially produced œdema, inflammations subside, suppurative processes are hastened, or sometimes aborted, and, in many cases, become localised, and, in consequence, are more easily dealt with.

The results attained by the pioneer of the method are almost incredible.

I propose, however, not to refer to them, but only to a few of such cases as have come under my own personal care, in the hope that they may be of sufficient interest to induce an extension of the form of treatment in general practice. I briefly refer to the method.

A piece of Martin's rubber bandage is applied at some distance above the site of inflammation tightly enough to obstruct the venous but not the arterial flow. Two or three turns of the bandage suffice. The requisite degree of tightness having been attained, the following phenomena are to be observed:—(1) the part distal to the bandage swells and becomes red; (2) the pain is relieved.

Should the part become blue and cold, the bandage must be loosened, while an increase of pain is usually an indication of undue tightness. If no alteration on the part is produced the bandage is probably too loose.

The requisite degree of tightness is the main point of difficulty, and several attempts may have to be made before this is attained. The method is, however, so simple, and its details so easily executed, that any patient of ordinary intelligence may, after the first demonstration, continue the treatment himself.

I would emphasise the facts:—(1) that the bandage must relieve, not cause pain; (2) that the limb must swell, but retain its warmth; (3) that it must become red, not blue or white in colour.

The bandage is not kept on continuously, but is removed from time to time, and reapplied in proximity to, rather than over, its original site. For the first few days, care must be taken to observe the progress of the inflamed area, as a small proportion of cases do not respond well to the treatment. If a wound is under treatment, the usual antiseptic methods are, of course, meanwhile observed.

I now pass on to a résumé of certain cases, recently brought under my notice in the course of practice.

Case 1.—Butcher, æt. 47. On October 12, a heavy knife cut into the middle joint of the second finger of his right hand. Patient dressed his finger himself. Three days later, he sent for me as he was in great pain, and had, during the morning, fainted twice. I found the hand red and much swollen, and there was a considerable amount of lymphangitis of the forearm, with a painful and enlarged gland in the axilla. The finger was tense and very tender; on pressure, pus exuded from the wound, and, on probing, the joint was penetrated, and some distance below there was contact with bare bone. Patient was feverish and felt sick. I applied an antiseptic dressing to the finger, and an elastic bandage round the arm as near to the shoulder as possible.

Patient says that, in half an hour, he was in comparative comfort. As I had advised him to keep the congestion up for nine hours, he did so, but, one hour after removing the bandage, the pain became so severe that he was glad to reapply it. (Subsequently he wore it for eleven hours at a time, with intervals of two hours.) On the following day, he was considerably more comfortable. The lymphangitis was distinctly less. His recovery was uninterrupted, and in a fortnight he was quite well. There had been no sloughing, but the joint creaked on movement, and, despite passive movements, ultimately became stiff, which, I think, was inevitable from the outset.

I need scarcely say that the patient was greatly pleased with the success of the treatment, more especially because of the rapid relief of his pain, and the successful issue, without resort to the knife.

Case 2.—At present, I am in attendance upon an old lady, æt. 72, who has an extensive septic cellulitis of the right hand and forearm, the result of a small punctured wound in the forefinger. I first saw the case on the third day after the injury. The patient was extremely ill, pulse 115, temperature 102. She was sick, had severe headache, and looked thoroughly done up. The pain was constant and very intense. The wound had closed and there was no sign of pus.

The bandage was applied as near to the shoulder as possible, with an almost instantaneous relief of pain. On the following day, I enveloped the affected parts in an ichthyol soak. The patient made a rapid recovery. Wearing the bandage, she slept fairly well at night. The signs of toxæmia rapidly diminished. By the end of a week, the more serious symptoms disappeared entirely.

This promised to be an exceedingly bad case, and, without the aid of the congestive treatment, would undoubtedly have been serious.

Case 3.—Gonorrhœal rheumatism. Man, æt. 36, who had been through the hands of several practitioners, without experiencing relief. He was exhausted from want of sleep. As the knee was the part most affected, I applied the bandage about the middle of the thigh. The pain was so much diminished in consequence, that the patient was enabled to sleep, which was the first step towards recovery.

Case 4.—Callous ulcer in lower one-third of leg. This occurred to a schoolboy, the result of a kick at football. Having resisted all forms of treatment for some weeks, it responded in five days to passive congestion, being then completely healed.

Case 5.—Poisoned wound of forefinger. A few weeks ago, I was consulted by a young woman, suffering from a septic wound in the forefinger, which was badly swollen and exceedingly painful. As there seemed to be some fluctuation, I felt inclined to make an incision, but, as she dreaded this, we decided to try the congestive treatment. The bandage was applied about the middle of the forearm.

The relief of pain in this case was not so well marked as in some others, but there was so much improvement in the condition of the finger that, in three days, the patient, feeling almost well, gave up all treatment, keeping only a covering of dry lint over the wound. There was a subsequent relapse, the finger became again acutely inflamed, but a few days of passive congestion restored it to a healthy condition, while pus, which had appeared beneath the nail, became absorbed.

In treating boils, or such conditions as are not controllable by a bandage, the part may be rendered œdematous by cupping. Suitable glasses are now made for the purpose.

My experience of this mode of treatment has not been so satisfactory as the other, but it has been more limited. The suction treatment of boils is, however, no new thing, it having been practised by employees in the ironworks in the West of Scotland and elsewhere, long before "passive congestion" was dreamt of. In the relief of pain in the long bones in syphilitic cases, passive congestion has also been of service, in at least two cases which have come under my notice.

Finally, I may remark that more serious conditions, such as osteomyelitis and middle ear disease, have proved amenable to this form of treatment, though I have had no personal experience of them.

The cases mentioned above are but a few of many in which I have successfully used Bier's passive congestion. They could be multiplied considerably, but if these, to which I have referred, are sufficient to indicate the value of the treatment to the practitioner in the management of everyday ailments, and are of interest enough to induce him to give it a trial, the object of these notes has been amply attained.

In conclusion I must express my great indebtedness to Mr. C. W. Cathcart, through whom I was first led to adopt the method, and in whose wards I first witnessed a demonstration of the technique by its originator, Professor Bier.

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DEVIATIONS OF THE NASAL SEPTUM, AND THE KILLIAN SUBMUCOUS RESECTION.

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Among the manifold conditions, developmental or pathological, which induce nasal obstruction with all its attendant train of evils, that which is due to a bent, twisted, or, as it termed, *deviated* septum, is, in adult life at any rate, the most common. Indeed, there is a tendency in some quarters to attribute more evils to this asymmetrical structure than is consistent with sound observation. At the same time, there can be no doubt, first, that deviations of the nasal septum are responsible for a very large number of cases of nasal obstruction, and secondly, that, with the exception of those instances in which a definite projection from the septum of cartilage or bone, the so-called "spur," is the obstacle to the free passage of air through the nose, no operative procedure short of a complete readjustment of the whole septum is likely to remedy effectually the disability for which these patients seek relief. And even in the case of spurs, which can be removed, in many cases, easily and quickly by the saw or spokeshave, opinion is gradually veering round to the position adopted by Killian, that they should not be considered as isolated phenomena, but as part and parcel of a general displacement of the septal cartilage or bones, and, consequently, that the proper method of treatment is not simply to shave or saw them off, but to deal with them in the course of an operation which is undertaken with the object of rectifying the whole septal deformity.

Now, in the past, septal deviations have been too often the reproach of the rhinologist. Not that there was any dearth of operations, suggested and carried out, for the straightening of the crooked nasal paths. Far from it. Of operations and of modifications of operations there was no end. And yet the reproach existed. Patients, it is said, had been known to make pilgrimages to all the famous rhinological shrines of Europe and America in a vain search for an operator, who could succeed in curing their troublesome malady. And it is no exaggeration to say that many rhinologists seemed about to give up in despair the task of rectifying the worst forms of septal deformity, when Killian, of Freiburg, devised his simple, ingenious, and radical method of "submucous resection." For the cure of many of the slighter and uncomplicated forms of deviated septum, the older operative measures were without doubt quite well adapted. As we have already seen, the obstruction caused by a septal spur could be easily relieved by a very simple operation. And, in like manner, in the simpler forms of septal deflection, operations such as Asch's, Moure's, etc., frequently cured the malformation. But, in the more extreme varieties of deflection, particularly in those instances in which the displacement was traumatic, and in those varieties, sometimes traumatic and sometimes merely developmental, in which there was a bilateral thickening of the septal partition, then even the most skilfully carried out of the older operations could not be relied upon to remedy the deformity. In other cases, again, so extreme was the deflection in the septal cartilage that no operative measure could succeed in removing the obstruction without at the same time making a perforation in the septum, which, although in many cases, perhaps in most cases, did not lead to any inconvenience, yet, in some, it induced secondary discomforts so troublesome as to beget displeasure in the minds of surgeons with the ultimate results of all septal operations. It is claimed for Killian's submucous resection that even the most extreme deviations can be rectified without the production of a perforation, and while many doubt whether this claim can be made good without any exception, there is, nevertheless, a general consensus of opinion that this operation is a great advance on any previous plan.

Since Killian first published his operation, it has undergone many modifications and "improvements," and has had to run the gauntlet of scepticism and criticism in all quarters of the globe, but it has emerged from these experiences unaltered as to its main features, and, so far, unscathed by all the objections which have been raised against it. Time is, however, necessary before we can say that the benefits of the operation are not only immediate but permanent.

No operation is more easy to describe than Killian's submucous resection. No operation looks prettier on paper. But no operation is more difficult to perform in the ideal fashion, for as each septum differs from another in disposition, so, while the main lines and principles to be followed are the same for all, each case demands a different application of these lines and principles. Let us, first of all, describe the operation in a typical and simple case of deviation to the left, where the convexity of the bend in the septum is directed towards the left nostril, obstructing it more or less, while the concavity of the septum is to be found in the right nostril, which is, therefore, roomier than it ought to be.

Anæsthesia.—In England, as a rule, the operation is performed under a general anæsthetic, since thereby more time is afforded, and we are able to proceed with that deliberation and caution by which alone we can command success. Abroad, however, both on the Continent and in America, the operation is most frequently performed under local anæsthesia only, by cocaine, or one of its substitutes, combined with adrenalin, and, as a matter of fact, local anæsthesia has much to recommend it. To begin with, local anæsthesia is safer than general anæsthesia, that is to say, unless the surgeon can obtain the services of an anæsthetist skilled in nose and throat work. Further, the patient, when conscious, can himself assist the operator by altering the position of his head at certain important junctures. And, finally, when under a local anæsthetic, the patient is sitting up, a position which of itself is a great advantage to the surgeon, inasmuch as the illumination of the field of operation is more perfect, the blood rapidly flows away from the wound without requiring to be mopped up, and the surgeon is more comfortable than when he has to lean over a recumbent patient and peer into a narrow cavity into which blood is constantly welling. If, however, an experienced anæsthetist is available, the discomforts of the patient's prone position are more than counterbalanced by the knowledge that there is no hurry, and that we can carry the operation to a finish without any fear of the anæsthetic losing its effect. Under the care of a skilled anæsthetist, the patient is quite as safe as, and much more comfortable than, when he is being operated on under cocaine.

Preparation of the Field of Operation.—Although it is a well-known fact that, unless there is purulent disease in one or other of the accessory sinuses, the nasal cavities are sterile, yet this does not apply either to the vestibule, with its cutaneous lining and hair-follicles, or to the upper lip, especially when it is adorned with a germ-trap in the shape of a more or less filthy moustache. In our operative manipulations, it is impossible for us to avoid contact with one or both of these regions, while the close proximity of the open mouth is another peril which the nasal surgeon dares not ignore. The vestibule of the nose and the upper lip, therefore, should be carefully cleansed, according to the rules of aseptic surgery, and the mouth should be rendered as aseptic as possible. The cutaneous surface of the nose should also be scrupulously cleansed, as the operator's fingers are constantly resting upon the bridge in performing the operation. It is a wise precaution to cover the upper lip, and, if the anæsthetist will permit, the mouth, with one or two folds of sterile gauze held in position by forceps. Or, what is much better, a face-mask of sterilised calico, covering the nose, cheeks, and upper lip, with holes for the eyes and anterior nares, may be employed.

Whether the operation is to be conducted under a general anæsthetic or not, the local application to the mucous membrane of the nose, or the submucous injection of 10♏ of a 1 to 10,000 solution of adrenalin with about 5♏ of a 1 per cent. watery solution of cocaine is necessary to lessen the flow of blood, which otherwise would interfere seriously with the operator's view and add materially to the length of the operation. Needless to say, the surgeon should make himself intimately acquainted with the anatomy of the nose upon which he is about to operate.

These preliminaries having been discussed, we will now turn to the operation itself.

Standing at the patient's right side, the surgeon inserts a nasal speculum into the nostril, where the convexity of the deviation is to be found; in the case we are considering this side is the left. Then, under bright illumination from headlight or mirror, an incision is made, by means of a small narrow-bladed knife with a rounded point, into the mucous membrane of the septum from just above the roof of the vestibule down to the floor of the nose. The incision should be curved with the convexity forward, or L-shaped with the horizontal limb of the incision running back parallel to the floor of the nose. (*See* Figs. 1 and 2.) The mucous membrane and perichondrium of the septum being intimately connected (the *muco-perichondrium*), the knife passes through them as through a single layer, down to the septal cartilage. Next, a flat perichondrial elevator, or separator, with blunt round edges, having been passed into the incision, is insinuated between the muco-perichondrium and the septal cartilage. The separator thus introduced is carefully passed upwards, backwards, and downwards, so as to raise the membrane from off the cartilage all over and around the obstructing portion of the septum, the convexity, that is. (*See* Fig. 3.) The separation must be effected without any tearing of the edges of the incision, and, of course, without making a "buttonhole" through the muco-perichondrium. In many cases, the separation is easily managed as the muco-perichondrium is but loosely adherent to the underlying cartilage. The extent of

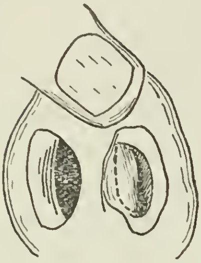

Fig. 1.

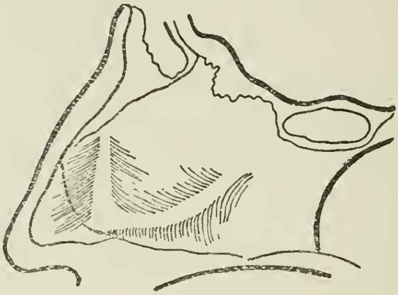

Fig. 2.

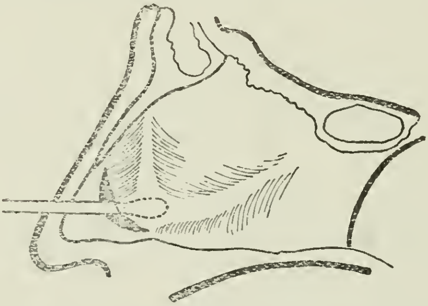

Fig. 3.

separation of the muco-perichondrium depends upon the extent and degree of the bend in the septum. No harm can be done by separating too much, but, if too little is separated, perforation of the septum, the bugbear of the operator, will be inevitable. The next step in the operation is to cut right through the septal cartilage in the line of the original incision so as to obtain access to the concave side of the septum, the right, *without wounding the muco-perichondrium on that side.* To be successful in this delicate manipulation, much practice is necessary, since the proper depth of the incision in the cartilage can only be gauged by the sensation conveyed from the point of the knife—for this reason a knife with a rounded point is preferable to a knife with a sharp point—or from a finger on guard inserted into the concave nostril. When the operator is satisfied that the cartilage has been completely divided, he passes the separator through the division so as to raise the muco-perichondrium from off the septum of the concave side. The situation and extent of muco-perichondrium separated on this side should be made to correspond with what has already been done on the convex side. And, of course, it also should be performed slowly, thoroughly, and without making a buttonhole. When these steps have been completed, the following is the state of matters. The bent cartilaginous plate, which forms the misshapen nasal septum, has been freed from its investing membrane of muco-perichondrium on both sides, and this has been done through a single incision on the convex side of the septum. It only remains to remove the cartilage without further damaging the muco-perichondrium, and the operation will be finished. In order to effect this safely, various guards have been devised, modifications for the most part of existing nasal specula. The essential of the guard is that it shall have long thin blades, which can be passed between the loosened muco-perichondrium of both sides and the cartilage. This is done by inserting the closed blades into the incision, and then opening them slightly so that one blade is on one side of the cartilage and the other on the other side. Then the blades are pushed horizontally backwards between perichondrium and cartilage as far as is necessary. When they are properly *in situ*, the blades are opened as wide as is deemed proper, in order to raise the muco-perichondrium clear of the cartilage and that now appears, isolated and free, between the opened blades of the speculum, and nowhere adherent to muco-perichondrium (Fig. 4). By means of Killian's "plough," or Ballenger's "swivel-knife," supplemented by suitable forceps, etc., the cartilage so isolated is completely excised. Then the speculum is removed, the two layers of muco-perichondrium are allowed to fall together, and a catgut suture is inserted in order to bring the edges of the original incision together. The misshapen cartilage having been entirely removed, the muco-perichondrial layers now lie in juxtaposition in the middle line, and all obstruction on the part of the septum is a thing of the past.

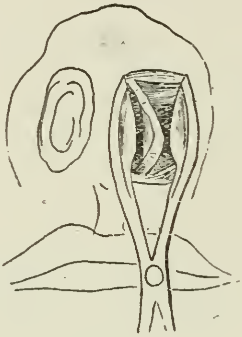

Fig. 4.

Like many other games of skill, the rules of this game are easy to grasp, but their successful application is extraordinarily difficult, taking one case with another. In the simple case which we have just described, the whole operation need not take longer than fifteen minutes. But these simple cases form only about 1 per cent. of the whole. As for the others, every possible variety may be met with, demanding both ingenuity and patience to overcome the particular difficulties presented by each.

Mistakes, Complications, Varieties.—The first mistake is to make the preliminary incision too small or too straight. The penalty for this error is that in our subsequent manipulations the muco-perichondrium will be torn, and the lips of the wound rendered ragged, so that they will not approximate comfortably at the end of the operation. Another error to be guarded against is that of making the incision too far back in the septum. If this is done, not only does it increase the difficulty of our subsequent manipulations, but it may lead to a considerable portion of the septum being left behind, and this may be quite sufficient to obstruct the nostril, particularly if the bend in the septum is situated near the front.

Hæmorrhage.—Bleeding may be very troublesome, not only because it obstructs the operator's view, but also because it may embarrass the respiration, and add to the anæsthetist's difficulties. We endeavour to forestall this complication, as we have already seen, by the preliminary use of adrenalin and cocaine, and generally with success. But it sometimes happens, in stout, full-blooded individuals, that these drugs have very little effect. Assiduous swabbing, however, will enable the operator to see, and, with a little patience and pressure, the bleeding will stop. With a patient under a local anæsthetic, and in the upright position, bleeding, even if it does occur, is less of a nuisance than when the patient is under chloroform. After the operation is over, hæmorrhage can always be easily controlled by plugs of gauze in the nose.

Next we have the *separation of the muco-perichondrium* to consider. On the successful separation and elevation of the muco-perichondrium, the whole success of the operation as such depends. The chief difficulty which we have to encounter is that of making a sufficient separation of the membrane from the cartilage without making buttonholes. There is, as a matter of fact, little or no harm in a small buttonhole on one side so long as it does not correspond in position with another buttonhole on the other side. If it does correspond a perforation is sure to result, and the patient will have been submitted to all the risks of a chloroform operation for a benefit, which could have been obtained quite as well in a few seconds under nitrous oxide. With regard to the separation of the muco-perichondrium, it may be laid down as a rule that the more considerable the deflection, and consequently the obstruction, and the more necessary the operation, so much the more firmly is the muco-perichondrium adherent to the cartilage, and the more difficult it is to effect the separation without making buttonholes. Cases in which the deflection is the result of injury, "broken nose," to wit, are the worst of all, since cicatricial adhesions, often very hard and fibrous, bind the perichondrium down to the cartilage. In cases such as these, the utmost delicacy and the most careful judgment are requisite to determine every movement of the separator, for it is more easy to drive the point of the separator through the friable muco-perichondrium than through the adhesions. Not only so, but, if a blunt separator is used to break down firm adhesions, the sheer pressure of the point may tear the muco-perichondrium. Then, working, as we do, more or less in the dark, it is obvious that, when once a buttonhole is made, the surgeon, thinking that he has passed the region of firm adhesions, may proceed to make the false opening larger and larger. In cases in which the angle of the concavity in the septum is so acute that the septal cartilage looks almost as if it were doubled on itself, firm adhesions in the depth of the angle are the rule, and it may seem impossible to strip off the muco-perichondrium without buttonholing it. But with care, gentleness, and, above all, deliberation, the adhesions may be divided without accident, and the operation proceed along typical and satisfactory lines. For the division of the hardest adhesions a sharp-edged separator may be required, but, in the hands even of an expert, a sharp separator is a dangerous tool, for it is much easier to cut through the soft muco-perichondrium than through the adhesions. In using this instrument our plan is to keep the edge of the separator in such close contact with the cartilaginous surface that it feels as if it were grating. Here again a word of warning is necessary. If the sharp-edged separator is too closely pressed against the cartilaginous surface, the instrument will cut through the cartilage, and appear on the opposite side of the septum, a little accident which multiplies a hundredfold the subsequent difficulties of the operation.

It may be asked, how are we to know when we have made a buttonhole? The answer is, when the point of the instrument feels to have suddenly become free. When once a buttonhole is made, the separator should be withdrawn a little under the muco-perichondrium again, and passed backwards at a higher level than the false opening, then the shaft of the instrument is depressed as a whole. By doing so, the opening will remain a mere slit in the membrane.

Another source of difficulty, met with in about half of the cases, is the presence of a spur or outgrowth of bone from the septum along its insertion into the floor of the nose. This spur is variously named "the basal spur," the "maxillary crest," etc. Into the causes of its formation we need not digress. Suffice to say that it is a frequent cause of obstruction, and one for the overcoming of which none ot the older operations provided a means. If the cartilaginous septum alone is rectified in such cases, and no attention is paid to the maxillary crest, the result will be disappointing both to surgeon and to patient. It may be dealt with after the following manner:—After the cartilaginous septum has been excised by the plough or swivel-knife, the muco-perichondrium, or rather periosteum, over the spur is carefully elevated, just as the perichondrium over the cartilage was, and the blades of the guarding speculum are readjusted so as to provide an easy and efficient approach to the spur. Then, by means of a small bent chisel, the bone is cut away. Free hæmorrhage follows its removal. Finally, chips and spikes are carefully removed with suitable bone forceps, of which Charles Heath's are perhaps the best, and the two layers of perichondrium are brought together as before.

Again, it may happen that the chief seat of deviation is in the bony septum at the back of the nose. Heath's forceps are very useful for the removal of these posterior deviations. It is, of course, very difficult to make sure when the muco-periosteum in the deeper portions of the septum has been properly separated, but, in cases of difficulty, the operator may cheer himself with the reflection that the production of a perforation at the extreme back of the nose is a source of much less inconvenience to the patient than a perforation through the anterior or cartilaginous portion of the septum. Indeed the probability will be that the patient will never suspect its existence.

In all cases, before the patient leaves the operating-table, the surgeon should assure himself that the obstruction, wherever it may happen to have been situated, has actually been removed. Otherwise his labour is vain, and the operation, be it never so pretty and artistic, is nothing more than a surgical episode. *It is better to make a perforation than not to cure the obstruction.* In order to test the patency of the nasal passages, I am in the habit of passing my little finger into each meatus and back to the posterior choana, or as near thereto as is possible, the sensation obtained in one side being compared with that obtained in the other. In examining in this way, one must be careful, in passing the finger into the nostril in which the incision has been made, not to hook the point of the finger into the flap of muco-perichondrium and tear it backwards. If the surgeon's finger is larger than the nose he is operating upon, each nostril may be stopped up in turn, the mouth closed, and the breathing through the nose tested in this way.

The *after-treatment* is as a rule quite simple. A little emollient ointment is snuffed up each nostril to soften crusts, etc. Douching and syringing are better avoided. In uncomplicated cases, the patient may be allowed to get up two or three days after the operation. If tampons have been inserted in order to maintain the perichondrial flaps in position, or to control hæmorrhage, then they must be removed not later than twelve hours after the operation. Otherwise their presence will act as an incitement to the development of septic troubles.

REVIEW OF RECENT LITERATURE OF SYPHILIS AND VENEREAL DISEASES.

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EXPERIMENTAL SYPHILIS.

Professor Neisser, in a communication made to the Medical Congress at Lisbon (*Bulletin de la Soc. Française de prophylaxie sanitaire et morale,* Nos. 4 and 5, April and May 1906), alluded to the progress that had been made, in recent years, in questions relating to the pathology and treatment of syphilis, principally due to the discovery of the pathogenic organism of the disease, and to the experimental inoculation of animals capable of contracting it. The recognition of the spirochæte was of the greatest value in determining the diagnosis of doubtful cases, and, if we could ascertain the conditions under which this organism existed, and could also devise measures by which its virulence could be attenuated in the human subject, we could still further facilitate, not only the diagnosis, but also the treatment of syphilis. Experimental inoculation of monkeys proved that it was impossible to introduce the virus of syphilis, without the production of a typical primary lesion or chancre ; subcutaneous injections were not followed by infection, nor did they produce immunity, but he had succeeded in transmitting the infection by rubbing with the syphilitic virus a testicle which had been incised. The contagion of all the syphilitic products, whether in the primary, secondary, or tertiary stage, had been verified, excepting in the case of tertiary neoplasms in process of degeneration. It was true that, at present, the spirochæte had not been found in tertiary lesions, but there was no reason to doubt that it was the organism specific to the disease. The number of spirochætes might be so limited that it was difficult to discover their presence, and possibly the tissues, chosen for histological examination, were in a process of degeneration, or suppuration, or possibly, in the evolution of these organisms, there might be some intermediate forms not yet recognised.

He had, for a long time, insisted on the necessity of treating the tertiary manifestations with mercury, for it was not only necessary to treat the symptoms of the disease, but also to destroy the spirochætes, a result which could only be obtained by prolonged mercurial treatment. The presence of the spirochætes in the enlarged lymphatic glands had been proved, as also the fact that successful inoculation could be obtained from them, and it might ultimately be possible, by an examination of the glands for the presence of the organism, to state whether a patient was capable of conveying the disease, either by direct contagion, or by hereditary transmission. As regards the blood, recent experiments on monkeys have confirmed the opinion that, at the onset of secondary manifestations, the blood sometimes contains the infective agency; at present, however, it was impossible, by examination of the blood, to arrive at a diagnosis, though, possibly later, we might be able to dislodge the spirochæte from its lurking place, and drive it into the general blood stream. Neisser had, after several attempts, failed to obtain a successful inoculation from the semen, though, on one occasion, Finger had been successful. He had proved the contagious properties of all the organs in hereditary syphilis, even of the nasal mucus, which was sufficient evidence of the danger of the syphilitic infant to those with whom it was brought into contact.

Everyone had experience of the varying degrees of intensity of the syphilitic virus in the human subject, but the reasons for these variations had not been ascertained; Metchnikoff had discovered that the anthropoid apes had a far greater predilection for the disease than those of a lower species; the chimpanzees and the gibbons were the most susceptible, and in them the disease closely represented that of man; but, in the lower degrees, the animals were only susceptible to inoculation on the eyebrows and on the genital organs. Studies on the evolution of the disease in monkeys were of the greatest importance, as they enabled us to elucidate a number of problems, which could not be cleared up by the clinical aspect of the disease. For instance, at present, it was impossible to say whether a syphilitic subject was completely cured or not, but in monkeys, one might, at any stage of the disease, study the degree of contagion present, and possibly one might ultimately be able to make a differential diagnosis between a case of syphilis cured, and one of latent disease. Again, it was generally considered that syphilis conferred immunity, since cases of re-infection, if they existed at all, were of extreme rarity ; but was this a true immunity, and might it not be due to the existence in some part of the organism of a small focus of infection ? Further, no one could state at what period the disease became constitutional, whether, for instance, the chancre was the seat from which the infection was derived, or whether it was merely a symptom of an already generalised infection. On this point depended a problem in the treatment of the disease, as regards the excision, or the destruction of the primary lesion ; experimental evidence on that point was not decisive, still, so far as his practice was concerned, Neisser was in the habit of excising the initial sore, unless that procedure necessitated too extensive mutilation of the organ involved. Metchnikoff had stated that the application of strong mercurial ointments destroyed the syphilitic virus, if applied from one to eighteen hours after inoculation, but Neisser had not met with similar success ; on the contrary, though the mercurial ointment was applied one hour after the inoculation, the chancre developed in due course. As regards the attempts to discover some method of immunisation against syphilis, they had all resulted in failure; no truly attenuated virus had been produced, either by the passage through some intermediary animal, or by any chemical or physical procedure. Either the virus was absolutely dead, or it produced the customary chancre.

He had carried out experiments with a view of determining whether the introduction of mercury into the organism in any way influenced the evolution of the disease, and he had observed, (1) that the chancre developed in the same manner in a mercurialised subject, as in one not subjected to that treatment. Injections of Hg were commenced on the same day as the inoculations were made, and nevertheless the indurated chancre developed in the customary period ; (2) the disease became generalised in an exactly similar fashion amongst the animals which had been mercurialised, and those which had not. When we had found the foci, in which the spirochæte localised itself at the apparent termination of the eruptive stage, we should know better what steps to take in order to destroy them. We should avail ourselves of every method by which mercury might be introduced into the system, and attack every locality invaded by the spirochæte, with special reference to those regions in which the virus was known to be present.

THE SPIROCHÆTE PALLIDA IN SYPHILITIC DISEASES OF THE EYE.

Sydney Stephenson (*Ophthalmoscope*, March 1906) states that he has found the spirochæte in the corneal lesion in two cases of keratomalakia in syphilitic babies, the eye being a situation in which that organism had not hitherto been discovered. The secretion from the ulcerated surfaces was smeared on cover-glasses, and stained by Giemsa's method, when a small number of spirochætes were found in each instance.

Rolleston (*The Medical Press*, March 1907) describes two cases of syphilis simulating typhoid fever, and emphasises the importance of bearing in mind the possibility of syphilis in dealing with obscure cases of fever. The patient, especially if a woman, will often deny, or be unaware of, the existence of syphilis. Fever in syphilis can exist apart from any other manifestations of the disease, a condition to which the name "essential syphilitic fever" has been given by Fournier, in order to distinguish it from the symptomatic fever which is associated with obvious syphilitic lesions. In the first case, marked signs of cerebral syphilis were present, though a healing chancre was present on the penis ; there was bilateral ptosis, violent delirium, considerable enlargement of the liver, together with fever of a low grade, and of an intermittent type. The fever in late syphilis has been attributed, by some authorities, to the damage done by syphilis to the liver, which is prevented from acting as a filter, and which consequently allowed the passage of fever-producing toxines into the general circulation. It might also be explained, by a secondary infection of the gummata in the liver by pyogenic organisms, which had gained access either by the bile passages or the blood. Another explanation of the pyrexia was that of Westphalen, viz., that it was due to the natural reaction against the spirochæte pallida and its toxines.

In the second case, the patient was admitted with the diagnosis of typhoid fever ; she presented the dazed condition, characteristic of enteric fever, had sordes on the teeth, and a thickly coated and tremulous tongue, together with a temperature of 102·6. Examination of the abdomen did not yield any confirmatory evidence of typhoid fever, there being no abdominal distension, or splenic enlargement. On the day after admission, a generalised macular eruption was noted, together with inflammation of the labia minora, and mucous tubercles in the mouth. For four days after admission, her temperature was undoubtedly indicative of typhoid fever, rising to 103 in the evening, and subsequently declining to about 100 F. Under anti-syphilitic treatment, her symptoms, including the pyrexia, rapidly abated, and she was discharged relieved in nineteen days.

SYPHILITIC ALOPECIA.

Hermann G. Klotz (*Journal of Cut. Diseases*, March 1907), considers that alopecia is not nearly so common a feature of syphilis as might be imagined from the usual descriptions in text-books. In a certain number of cases, malnutrition and subsequent loss of hair occur, sometimes becoming manifest only by a dry and lustreless condition of the hair, or by an almost entire loss of the hair, not only of the scalp, but also of other hairy parts of the body, evidently as the consequence of the general infection of the system with the syphilitic virus, and as a result of malnutrition of the body in general. Such an effect is not a specific one, peculiar to syphilis, but is more or less commonly observed in infectious diseases, particularly in those of a short cyclic course attended by high fever, such as typhoid fever, erysipelas, septicæmia, and the acute exanthemata. As a rule, it is proportionate to the intensity of the intoxication, and of the symptoms, as expressed principally by the rise of temperature, or degree of fever. In cases, in which the prodromal symptoms are severe, as manifested by pyrexia, headache, "rheumatic" pains, loss of appetite and sleep, a loss of hair might be observed usually in proportion to the general nervous symptoms, but the alopecia bears the same relation to syphilis as does the alopecia following typhoid fever. Besides this general alopecia, another form is described, in which the loss of hair occurs in round and oval patches, not symmetrically arranged, but usually distributed over the back and upper portion of the head. They produce a peculiar appearance, described by some as moth or mouse-eaten, or mangy, or looking as if the hair had been carelessly cut with a dull pair of scissors. Bald patches also appear on the bearded portion of the face, and particularly in the eyebrows, either as a break of the arch, or as complete loss of the outer portion. The appearance of this imperfect alopecia, at a certain stage of syphilitic infection, suggests a close connection with some local action of the syphilitic virus, and justifies its classification as a manifestation of the late secondary class. It usually follows a sluggish course, lasting over months and even years, thereby causing great annoyance and mental agony to the patients; it was, however, usually followed by a more or less complete restitution of the hair. Lesions of the tubercular and gummatous ulcerative types might, of course, be followed by alopecia, but here the loss of hair is due to the incidental destruction of the papillæ and the entire hair-producing portion of the skin, and its cicatrisation.

Klotz summarises his views on syphilitic alopecia, as follows:—

1. Alopecia, or loss of hair, is *not* a common or regular symptom of the early stages of syphilis.

2. The slight loss of hair, which is constantly taking place in healthy individuals as the result of the physiological change of hair, continues its existence through and beyond the course of syphilis, and must be taken into consideration before attributing to syphilis a loss of hair, so slight as to pass unnoted, or scarcely attract the patient's attention.

3. The same rule applies to numerous cases of slight seborrhœa of the scalp, which, under ordinary conditions, would not be considered worthy of notice or treatment.

4. In a certain number of cases, syphilis may be accompanied by diffuse loss of hair, which may extend more or less over the entire scalp, varying in degree, similar to that observed after other infectious diseases, such as typhoid fever, erysipelas, etc.

5. In the absence of any discoverable local changes in the skin, this alopecia is apparently the result of malnutrition of the hair, its appendages and the entire skin, as part of a general modification of the entire organism by the infection with the virus.

6. This alopecia is therefore not strictly a symptom of syphilis, directly due to the virus, but rather a complication.

7. This alopecia is directly dependent upon, and, in most instances, proportionate to the general symptoms, which may accompany the second period of incubation, and usually makes its appearance several weeks after the onset of these prodromal symptoms, similarly to other infectious diseases like typhoid.

8. Although this alopecia may be very extensive and affect other portions of the body, it shows a tendency to more or less complete restitution of the hair, unless the patient is too advanced in years, or is a subject of hereditary tendency to baldness.

9. An alopecia occasionally occurs in the form of ill-defined irregular, small, sometimes coalescent patches of baldness, distributed principally over the back and upper portions of the scalp, and giving it a mangy or moth-eaten appearance.

10. This alopecia is observed almost exclusively in syphilitics, and is so characteristic, that, with extremely rare exceptions, it is diagnostic of syphilis of the affected individual, either acquired or hereditary.

11. This alopecia is a characteristic symptom of syphilis, and almost always occurs at a period more or less remote from the time of infection, usually not before the end of the first year and up to the end of the second year. It generally follows a very tedious course, although terminating in restoration of the hair.

12. In the absence of any discoverable anatomical changes of the skin, due to a local specific process, it is very difficult to explain the origin of this alopecia in patches.

THE OPERATIVE TREATMENT OF ACUTE GONORRHŒAL EPIDIDYMITIS.

Dr. F. R. Hagner (*New York Medical Record*, October 13, 1906) alludes to the operative measures, which have been recommended in the past for the treatment of acute gonorrhœal epididymitis, such as puncture of the testicle (Pirogoff), incision of the tunica albuginea (Vidal de Cassis), and puncture of the tunica vaginalis (Spencer Watson). He agrees with Bellfield that though pus is only rarely present in gonorrhœal epididymitis, in a considerable proportion of the cases, where the tunica vaginalis contains fluid, and œdema of the skin is present, foci of pus exist in some portions of the epididymis. In confirmation of this opinion, he quotes the conclusions arrived at by Boerman, from the pathological study of twenty-eight cases. They are :—(1) In a considerable proportion of cases of epididymitis, abscesses are formed in the epididymis. (2) Suppuration is regularly followed by the appearance of hydrocele. (3) Gonococci are found in foci in the epididymis years after the urethral infection occurred. (4) Early puncture is advised to save the canal from occlusion. (5) The hydrocele should be punctured to improve the circulation. (6) Incision and drainage of the infected epididymis should be more frequently practised. Whilst fully realising that most cases of epididymitis will recover with only medical treatment, the author considers that many of the severe cases are analogous to pyosalpinx, and recommends incision into the globus minor, free evacuation of pus, and drainage. The operation employed is as follows :—At the junction of the swollen epididymis and testicle, an incision 6 to 10 c.m. in length is made through the scrotum down to the tunica vaginalis, which is opened, and the fluid contained therein evacuated. The testis and its adnexa are protruded from the tunica vaginalis, and multiple punctures are made through the fibrous covering of the epididymis with a tenotome. If pus is seen to escape from any of the punctures, the opening is enlarged, and a small probe inserted in the direction from which the pus flows, and the cavity is washed out with a solution of perchloride of mercury 1 to 1000. The testicle is then replaced, and the tunica vaginalis washed out with the perchloride of mercury solution, its cavity being then closed with a fine catgut suture, and a small gauze drain introduced.

In every case operated on, fluid was present in the tunica vaginalis, varying in amount from a few drachms to two ounces. The parietal layer of the tunica vaginalis was congested, and the portion of the membrane covering the epididymis was the seat of punctiform hæmorrhages. The epididymis was greatly thickened, specially in the region of the globus minor, which, in two cases, was found to contain gonococci. The relief was just as great whether or not pus was obtained, and was explained by the relief of tension. From the six cases operated on by this method, the author considered that the results warranted a further trial of the procedure, and justified the following deductions :—

1. According to the known pathology, it is a rational procedure.

2. If care is exercised, the danger to the patient is slight.

3. The infiltration of the epididymis disappears more rapidly under the operative treatment than under any other.

4. The danger of permanent injury to the testicle and epididymis is lessened.

5. The patients are absolutely relieved of pain on recovery from the anæsthetic.

6. The systemic symptoms are promptly relieved.

7. Medicinal treatment will usually be followed only by relative relief, and perhaps not by a permanent cure, because the infecting agent remains ; therefore the most rational way of effecting a permanent cure, is by incision, irrigation, and drainage.

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REVIEW OF SOME RECENT WORK ON DISEASES OF THE NERVOUS SYSTEM.

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A Study of the Causes and Classifications of Progressive Muscular Atrophy.—Dr. Charles L. Dana[1] has made a clinical study of 72 cases of progressive muscular atrophy of bulbar, or spinal, origin with a view of especially studying :—

(1) The clinical classification of these cases.

(2) The ætiology and especially ætiological relation of syphilis to the disease.

(3) The question of the proper status of so-called "chronic anterior poliomyelitis," and its relations to the atrophies.

Classification.—With regard to the status of amyotrophic lateral sclerosis, and its relation to progressive muscular atrophy, Dana found, among his list, only three cases of progressive muscular atrophy beginning with spasticity, and accompanied, dominantly throughout, with all the evidences of sclerosis of the lateral columns ; although by adding all the cases of progressive muscular atrophy, which were later associated with some evidence of lateral sclerosis, the number rises to 14. For these latter, Dana would preserve the title of progressive muscular atrophy, and would limit the use of "amyotrophic lateral scleroses" to those cases which show, only from the beginning and dominantly, the spastic and contracturing types of progressive muscular atrophy.

Since there is a close similarity in the ætiology, course, and termination of those cases of progressive muscular atrophy which begin in the arms and then ascend to the medulla, and those cases which begin in the medulla, or ocular nuclei, and then descend to the hand, arm, and legs, it is suggested that all the forms might reasonably be included under one name, and that they might be separated, for purposes of convenience, into those types which begin in the eyes, the bulb, the cervical, or the lumbo-sacral cord.

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[1] *Journal of Nervous and Mental Disease*, February, 1906.

According to this division, Dana found among the 72 cases, 3 of amyotrophic lateral sclerosis and 55 of the other form, and, of these 55, 11 began in the mid brain or bulb, and descended, while 33 began in the arms, and 4 in the legs and ascended. So that amyotrophic lateral sclerosis, ophthalmic, bulbar, and spinal progressive palsies are thus all brought into one group. A group designated "Progressive Occupation Atrophies" is then discussed. The characteristics, claimed for these cases, are that the atrophy begins in the shoulder girdle, and then passes to the hip girdle or *vice versâ*, after which it may slowly extend to the trunk and extremities, that the cases run a somewhat special course, and, in almost all instances, can be attributed to occupation, combined, perhaps, with some excesses that otherwise deteriorate the constitution. An example, occurring in a professional contortionist, is given. The close relationship of these cases to the muscular dystrophies is admitted, and in the absence of microscopical evidence, it seems somewhat doubtful if they can be definitely ascribed to a central lesion.

Dana, however, suggests that for the present they should be simply classed as "Progressive Occupation Atrophies," that have become extensively spread, and, owing to a weakened or defective constitution, have acquired a slowly progressive character, and he considers that their clinical recognition and differentiation are justified on the ground of their better prognosis.

The next point considered is whether there occurs a chronic anterior poliomyelitis otherwise than that which gives rise to the clinical condition, recognised as progressive muscular atrophy. After reviewing the recorded opinions, Dana sums up the situation by concluding that there is not yet established, on a sure pathological basis, such a disease as true chronic or subacute inflammation of the anterior horn cells of the spinal cord. The cases so reported are rather instances of subacute degenerative processes, secondary sometimes to vascular disease, and are probably related to the progressive spinal atrophies.

Such subacute progressive atrophies should, however, be recognised clinically, and it is probable that the process is primarily due to vascular disease, and is of specific origin.

With regard, then, to classification of the central forms of progressive muscular atrophy, Dana recognises three groups:—

(1) Bulbo-spinal type, including ophthalmoplegia, bulbar palsy, cervico-spinal atrophy and the various leg types.

(2) Progressive Occupation Atrophy, slower in course with a tendency to affect the shoulders, trunk, and hip girdle more than the legs and forearms.

(3) Subacute Anterior Poliomyelacia, coming on usually in remittent attacks, and probably of specific origin.

Ætiology.—Dana considers that the facts which he furnishes regarding the relation of syphilis to progressive muscular atrophy, are at least more than suggestive. In the 72 cases, 19 gave a history of syphilis (*i.e.*, just over 25 per cent.), while it is pointed out that, if the shoulder hip type of cases, which belong to a different category, are omitted, the percentage would be greater, and would doubtless be further increased if the antecedent history of all cases could be more definitely obtained.

Strenuous occupation is placed first among exciting causes, while lead is thought not to be such a potent factor as has been supposed.

The Function of the Third Left Frontal Convolution in the Mechanism of Speech.—One of the most interesting of the recent contributions to neurological literature is that of Pierre Marie[1] on Aphasia, in which doubt is thrown upon the part played by the third left frontal (Broca's) convolution.

His views are based on personal observation of almost a hundred cases, and on fifty autopsies. In the first place, Marie maintains that, in every case of aphasia, there is more or less difficulty in comprehending spoken language, a statement which is in conflict with views usually accepted that, in motor aphasia due to a lesion of Broca's convolution, there is inability to speak, but no difficulty in understanding. He is able to show that the intelligence of the patients shows considerable deficiency when any but the most simple demands on it are made. Marie then proceeds to show that speech can still be carried on, when the third frontal convolution of the left side is destroyed, and that, in a considerable number of cases of motor aphasia, there is no lesion of this convolution, and he arrives at the important conclusion that the third left frontal convolution plays no special part in the function of language.

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[1] *La Semaine Médicale*, 1906, May 23, October 17, November 28.

It is not of course denied that there is, in a large number of the cases of motor aphasia, a lesion of this convolution to be found, but it is maintained, that the destruction is not often confined to this particular area, and that, therefore, the interpretation, which has hitherto been put upon such instances, is erroneous.

Marie next examines the relations and definitions of the three conditions, known as Aphasia of Wernicke (auditory aphasia), Aphasia of Broca (motor aphasia), and Anarthria.

The clinical characteristic of Aphasia of Wernicke is that the patients are able to speak, but confuse their words, while their intelligence is defective, and that they cannot read or write. In the Aphasia of Broca (motor aphasia), the patients cannot read or write, and their understanding is also impaired, so that the cases of this variety closely resemble those of Wernicke's aphasia, with the difference that, in Broca's aphasia, the patient cannot speak, *i.e.*, the aphasia of Broca is the aphasia of Wernicke without the power of speech. Anarthria is characterised by inability to speak while the power of understanding is entirely preserved, so that, while it simulates Broca's aphasia in the loss of speech, it differs from it by there being no loss of understanding.

The symptoms of anarthria correspond with those known under the term "subcortical aphasia."

To sum up, so far Marie recognises three terms :—

(1) Aphasia of Wernicke, in which intelligence is impaired, but speech possible.

(2) Aphasia of Broca, in which intelligence is impaired, and no speech possible.

(3) Anarthria, in which the power of speech is impaired while intelligence remains clear.

The next question is concerned with the localisation of the lesions which produce these different symptoms.

In the case of Anarthria there is no difficulty, as everyone agrees that the lesion is in the region of the lenticular nucleus.

But while anarthria may result from a lesion in either hemisphere, aphasia only occurs when the disease is on the left side. With regard to the localisation of lesions causing aphasia, stress is at once laid on the fact that there is only one aphasia, for, as we have already seen, the aphasia of Broca differs, according to Marie, from the aphasia of Wernicke, only by the absence of power to speak, the intellect being always more or less impaired in both, and it therefore comes to this, that the aphasia of Broca is nothing else than aphasia of Wernicke accompanied by anarthria.

The area, disease of which gives rise to Wernicke's aphasia, is comprised in the supramarginal convolution, the angular gyrus, and the bases of the first two temporal lobes. This zone of Wernicke is considered to be the true centre for language, and to have an intellectual rather than a sensory function. Every lesion of this centre causes, in proportion to its extent, impairment of the capacity of understanding spoken language, and deficiency in the power of reading and writing, in addition to the difficulties of speech.

In order to have word-blindness (Alexia), it is necessary for the lesion to occupy such a position that it involves simultaneously the visual fibres and the white substance of the zone of language and the fibres proceeding from it, and the area of brain, in which such an effect can be produced, derives its blood supply from the posterior cerebral artery.

According to the position of the lesions, the aphasias may, it is suggested, be classified as intrinsic and extrinsic.

Intrinsic aphasia is that which is brought about by a lesion of the "zone of language" (Wernicke), or of the fibres that proceed from it. This form includes motor (Broca) and sensory (Wernicke's) aphasia in the sense hitherto accepted.

Extrinsic aphasia is that in which the zone of language (Wernicke) and its fibres are not directly involved, but in which the lesion is situated in the neighbourhood. If in the lingual and fusiform lobes, it produces alexia, and if, in the lenticular nucleus, anarthria, the so-called pure motor aphasia.

Some Methods of correcting the Tabetic Gait.—By the introduction of systematic exercises by Frenkel, it has become possible to correct, to a great extent, the incoordination of tabes. With a view of further facilitating the treatment of this symptom, Sidney J. Schwab and Nathaniel Allison[1] have considered the conditions, which make for ataxia, apart from those of strictly nervous origin, *i.e.*, the more mechanical part of standing and walking; and their paper deals with (1) the mechanics of the foot and ankle in tabetic gaits and postures, and (2) methods of improving the faulty mechanism, so that a tabetic will be given a fairly normal implement with which to walk. The tabetic, when standing, assumes a position which gives him a broad base, an advantage which is secured by strongly everting the feet and standing with the knees well apart, and the gait is a progression of this standing position. But there is a considerable mechanical disadvantage in either standing or walking with the foot in an everted position, since the body weight falls inside the tarsal arch, and the tendency is to roll the foot inwards, *i.e.*, to pronate it.

Accompanying this pronation of the foot, it is pointed out that the weight-bearing line also falls to the inside of the knee joint. This pronation gives the appearance of "flat" foot, but tracings of the authors' cases invariably showed that the arch had not collapsed. In some, the pronation was so pronounced that the outer edge of the foot was raised from the tracing paper.

On the results of the 15 cases examined, the authors are inclined to the opinion that the tabetic foot is a pronated foot; and that this pronation is the result of the tabetic changes in the cord and peripheral nerves, which make it necessary to assume this position. As the results of experiments, the authors found that a boot, made to correct, so far as possible, the tendency to erroneous individual positions, brought a good deal of comfort, and they finally conclude that:—

(1) Their series of observations has shown that the foot of a tabetic, with any degree of ataxia in the lower extremities, is a pronated foot.

(2) The effect of this pronation is undue muscular strain on the ankle, knee, hip, and spine, which, together with hypotonia, tends to break down the long arch, and to produce a faulty mechanical instrument with which to walk.

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[1] *Journal of the American Med. Association*, December 16, 1905.

(3) The pronated foot plays an important, and hitherto unrecognised role in the production of the ataxia gait of tabes.

(4) Correction of this faulty mechanism tends to increase the ability of the tabetic to walk normally.

(5) In conjunction with Frenkel's exercises, the correction of the faulty mechanism of the foot offers the most favourable treatment for the ataxia gait of tabes.

Diet in Epilepsy.—Most physicians consider it wise for epileptics to eat sparingly of meat. Some prohibit meat altogether, while others pin their faith to a purin-free diet.

Dr. A. J. Rosanoff[1] has made some observations, which appear to show that the best results are obtained by allowing a moderate amount of proteid food rather than prohibiting it altogether.

On the assumption that epilepsy is the result of a faulty proteid metabolism, Rosanoff infers that it is not meat, or farinaceous material, as such, that is of importance, so much as the absolute quantity of proteid food, irrespective of its origin, that constitutes the dietetic factor of influence on the frequency and severity of the attacks. In order to test this hypothesis, eleven epileptics were kept on five different diets consecutively, the kind of food being systematically varied, and, for the purpose of eliminating the influence of exercise on metabolism, the patients were kept in bed.

The results of the experiments showed :—

(1) That the effects of a mixed diet in epilepsy differs in no way from that of a vegetable diet containing the same quantity of proximate principles. Consequently any belief that animal food has any effect, as such, is to be disregarded.

(2) That the quantity of proteids in the diet has a decided influence on the manifestations of epilepsy.

If it is *above* or *below* a certain amount, the severity of the disease is increased.

(3) That if there is any large excess of proteid in the diet, so that the organism is bound to use proteid in place of carbohydrate material, the number of convulsions increases enormously, and there is a general aggravation of both mental and physical symptoms.

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[1] *Journ. of Nervous and Mental Disease*, December, 1905.

The conclusion arrived at is: "That, just as the organism of the diabetic is unable to properly utilise carbohydrates, so the organism of the epileptic cannot take care of proteid material, as it is taken care of by the normal organism."

Since carbohydrates and fats are to a certain extent capable of replacing the proteids in the diet, the therapeutic indication is, Rosanoff considers, to give the epileptic the largest amount of carbohydrates and fats that he can assimilate without inconvenience, and the smallest amount of proteids, which is compatible with the preservation of the nitrogenous equilibrium. The amount of nitrogen ingested must not be allowed to fall below the amount excreted, otherwise a condition of proteid starvation will be established, in consequence of which the general health suffers, and the epilepsy is made worse.

Bone Reflexes.—D. Moica and L. Strominger[1] have recently contributed a paper on the reflexes that can be obtained in the upper limb from percussion of the lower end of the radius and ulnar, and of the humerus, and by percussion of the tibia and iliac crest in the lower limb. In normal people, these reflexes are most marked in youth, tending to diminish with advancing years, while in the aged they may be absent. In nervous diseases, as a general rule, these reflexes vary with the tendon reflexes, being increased, diminished, or lost under corresponding conditions.

While the authors are in some doubt as to the proportionate parts, which the periosteum and the bone take in the excitation of the reflexes, they find there is no constant relation between the presence of the reflexes and the vibratory sensibility of the bones. Suggestions have been made that the chief method in the production of these reflexes is by a mechanical transmission of the osseous vibration to the posterior roots, but Moica and Strominger think that the mechanism of production is similar to that of the tendon reflexes, in so far as the afferent path is by way of a branch of a sensory nerve.

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[1] *Revue Neurologique*, November 15, 1906.

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RECENT WORK IN DISEASES OF CHILDHOOD.

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RECURRENT VOMITING.

SINCE Dr. Gee wrote his paper "On Fitful or Recurrent Vomiting" in the St. Bartholomew's Hospital Reports for 1882, very little has been added to our knowledge of this disorder; but, during the past few years, interest has been aroused by new theories of its causation and the observation of closely allied conditions. Dr. Gee noted, as the characteristics of the disorder, "fits of vomiting which recur after intervals of uncertain length. The intervals themselves are free from signs of disease. The vomiting continues for a few hours or a few days. When it has been severe, the patients are left much exhausted." He pointed out that the disorder is one of childhood, and may begin in infancy. Pain in the upper part of the abdomen, or around the navel, often accompanies the vomiting, and may be severe. The bowels are sometimes costive, sometimes loose. In one of the nine cases which he recorded, there was considerable fever (103°) during the attacks.

Premonitory symptoms are patent in many cases, to a sufficiently careful observer. Dr. Gee mentions that, in one case, a boy, of 4½ years, became very sleepy, and that the stools were pale before the attacks. Pierson[1] describes an unusual acidity of the urine, and a sour fermented character of the stools, and the occurrence of slight nervous symptoms, such as twitching of the eyelids, or stammering, or headache just before the attacks; Rachford[2] and others have noticed sallowness of complexion, dark rings under the eyes, and flushing of the cheeks; Langmead[3] records a case in which watery diarrhœa occurred for a few hours before the vomiting began.

This occurrence of premonitory symptoms is of no little practical importance, for, as I shall point out, it is possible, in some cases, to abort an attack by prompt and vigorous treatment during the stage of premonitory symptoms.

The vomiting during the attacks is most intractable, even small doses of water or soda-water may be vomited, and the vomit may contain bile, and even be blood-stained. The bowels are nearly always constipated when the vomiting begins, and, as Rachford points out, the constipation may be very obstinate ; the association is noteworthy, for it has led to unnecessary laparotomy, a procedure most undesirable in a condition which is naturally sufficiently exhausting without the shock of operation. Swain[4] records two cases, in which this happened, one of which proved fatal.

The feature of this disorder with has attracted attention specially during recent years is the occurrence of acetonuria during the attack, and the sweetish, apple-like odour of acetone in the breath. This latter phenomenon has been noticed as a premonitory symptom in some cases. Since Marfan, in 1901, and Edsall of Philadelphia, in 1903, drew attention to this phenomenon, it has been found to be present constantly in the attacks ; but it should be realised that its presence is in no way pathognomonic of this disorder. Acetonuria is certainly present occasionally in diseases which bear no resemblance to recurrent vomiting. Langmead found accetonuria present in so many conditions, that he regarded it as improbable that it could bear any causal relation to recurrent vomiting. Moreover, as he points out, in diabetic coma, a condition associated with acetonuria and the presence of diacetic acid in the urine, and smell of acetone in the breath, vomiting is not a characteristic feature. The cause of recurrent vomiting, therefore, remains obscure. There is a general tendency to regard it as the result of some auto-intoxication, and to accept Edsall's view that the toxic substance is acid, a theory supported by the results of treatment with large doses of alkali.

Acetonuria is known to be a very common phenomenon after anæsthetics, whether ether or chloroform is used, and since Dr. Guthrie drew attention to the fatal effects of chloroform in children, who were found at autopsy to have a fatty liver, it has been supposed that the fatty condition of the liver may determine the fatal result in these cases, which resemble an attack of recurrent vomiting, not only in the condition of the urine, but also in the severity of the vomiting It is remarkable that, in the few cases of recurrent vomiting, which have ended fatally, a marked fatty degeneration of the liver has been found ; and, in diabetic coma, in which acetonuria and acetone smell in the breath are characteristic features, fatty degeneration of the liver is said to be common, although, in this condition vomiting is by no means frequent. Another condition in which acetonuria is a constant feature, and in which vomiting sometimes, but not always, occurs, is poisoning from excessive doses of salicylate. Dr. Lees pointed out the resemblance of these cases to diabetic coma, but hitherto no observations have been published, so far as I know, upon the condition of the liver in salicylate poisoning. The points of resemblance between recurrent vomiting and such conditions as poisoning from chloroform and from salicylate, and diabetic coma, strongly suggest that the explanation of recurrent vomiting is to be sought for in some form of toxæmia.

But there is another aspect of this disorder which has to be taken into account in considering its causation. Dr. Gee pointed out that excitement of any kind might bring on an attack, and also noted the occurrence of migraine in the parents of some of the children affected ; Dr. Rachford mentions the replacement of recurrent vomiting by migraine in four children, when they reached adult life ; and states that the children with this disorder are "one and all nervous, presenting variable degrees of general nervous excitability and restlessness." Holt[5] also has laid stress upon the nervous element in this recurrent vomiting, and mentions the case of a child, who had an attack upon any special excitement, for instance, in the night following his first day at school. My own experience of this condition, which is by no means an uncommon one in children of all classes, leads me to regard the association of a nervous temperament with recurrent vomiting as a frequent occurrence. It is, however, difficult to accept Fischl's[6] view that the attacks are simply manifestations of "infantile hysteria," excited by some slight gastro-intestinal disturbance. He bases his view on the supposition that recurrent vomiting occurs almost exclusively amongst the well-to-do, the class which furnishes most cases of hysteria, the known association with neurotic family tendencies, the sudden and unaccountable onset and cessation of the attacks, and the effect of modes of treatment which can hardly act in any other way than by suggestion ; for instance, the good results observed after removal of the appendix. Fischl mentions also the occurrence of acetonuria in hysteria with any gastro-intestinal disturbance. It would be rash to contrast the figures of private practice with those of hospital practice, but one may say without hesitation that recurrent vomiting is common enough in hospital practice amongst the poorer classes of this country, but this does not militate against Fischl's view, for neuroses of all sorts are common enough amongst the poorer classes.

In the diagnosis of recurrent vomiting, it is quite clear that the presence of much acetone and diacetic acid in the urine, or the smell of acetone in the breath, is of little or no value. Several observers have recorded instances in which these symptoms were well marked, but the disease proved not to be recurrent vomiting ; the diagnosis rests rather upon the history of repeated attacks, and the exclusion of other causes for vomiting. Townsend[7] mentions an attack, which was supposed to be recurrent vomiting, but was subsequently found to be appendicitis, and Holt and others have drawn attention to this source of error. The difficulty of diagnosis in a first attack is obvious, and it is only by thorough and careful examination of the child for such possibilities as meningitis, appendicitis, and intestinal obstruction, that serious mistakes can be avoided. Batty Shaw and Tribe[8] describe a case, in which there was so much pigmentation of the neck and body, in a child of 11 years, with recurrent vomiting, that they think Addison's disease might have been diagnosed by mistake.

The treatment of recurrent vomiting has become much more satisfactory since the administration of large doses of sodium bicarbonate was advocated by Dr. Edsall. Some have given this drug in large doses, such as a drachm, but, as Edsall pointed out, it is more satisfactory to give moderate doses at very short intervals ; for example, 10 or 15 grains every hour, when premonitory symptoms are present, or the attack is just beginning. In this way an attack can sometimes be cut short. Jacobi[9] stated that these symptoms were due, in some cases, to excess of fat in the diet, and in this he is supported by Edsall, who says that he has repeatedly known acetone and diacetic acid to disappear from the urine when fat was reduced or excluded altogether from the diet, and the intake of carbohydrate increased. Pierson[10] recommends that the bicarbonate of soda should be given dissolved in whey. In some cases it has been administered per rectum, and it has been necessary to give also subcutaneous infusions of sodium chloride.

CONVULSIONS IN INFANCY AND CHILDHOOD.

Probably most clinicians, if asked what was the commonest predisposing cause of convulsions in infancy, would say rickets; but, according to some interesting investigations by Dr. McIlraith,[11] neuropathic heredity is much more often the predisposing factor than rickets; the former was present in 57·2 per cent., the latter in only 37·6 per cent. Dr. Ashby[12] pointed out the same fact; "the hereditary disposition to convulsions," he says, "is probably the most important factor." The relation of dentition to convulsions has been much disputed. Dunn[13] says that there is little positive evidence in support of their connection with teething. It may be true, as Dr. Guthrie says, that "gastric, or intestinal, disturbance is far more frequently the cause than dental irritation"; but it is difficult to see any logical justification for supposing that irritation in the abdomen should be any more capable than irritation in the mouth of producing infantile convulsions. It has been said that "teething produces nothing but teeth," but the wag who invented this axiom either had no children of his own, or they must have passed through dentition with singular ease. Anyone who has watched an infant pulling irritably at its gums, and crying out with the short, fretful cry which is so common when the gums are tense and swollen, must know very little of the language of infancy if he requires to be told that these symptoms mean local worry or pain; and, if the irritation of worms in the intestine, or of some indigestible food, which causes apparently much less local worry than an erupting tooth, can cause convulsions, as most people very rightly believe, the obvious distress of teething seems *a fortiori* an ample cause for convulsions.

Dr. Eustace Smith[13] has recently recorded instances in which the mere taking of food, without any evidence whatever of indigestion, was sufficient to start convulsions in an infant. In these cases, he says that the attacks could be stopped by "ordinary treatment and some help to the digestion"; moreover, they were all hand-fed infants, so that no doubt there was some digestive difficulty; but the point of interest is the fact that they showed no sign of abdominal discomfort, nor any indication whatever of uneasiness between the end of the meal and the beginning of the seizure. Dr. Smith regards the convulsions as due to reflex irritation from the stomach. One of the cases recorded by Dr. Smith emphasises the need for caution in prognosis in any case of infantile convulsions; the infant was stated to be liable to these attacks immediately after food, and, whilst it was being watched during the administration of food to ascertain if this was the case, the infant became convulsed about two minutes after the meal was finished, ceased to breathe, and, in spite of artificial respiration, was dead within thirty seconds of the onset of the convulsion. Probably most physicians, who see many infants, have observed a similar catastrophe, which has served to make them regard infantile convulsions as never free from risk.

But there are other aspects of prognosis; parents often want to know whether convulsions are likely to affect the child's future adversely; is the child likely to prove epileptic? will the intellect be damaged? To these questions, very different replies have been given. Thiemich and Birk[14] traced the later history of 64 children, who had suffered from convulsions in infancy: two-thirds of these were found to be below the average in intelligence or morals, and these observers came to the conclusion that only a very small proportion of infants, who had convulsions, developed into normal children. In contrast to this pessimistic view may be quoted the observations of Dr. R. O. Moon,[15] who found that "about two-thirds seemed to be quite normal mentally," but he considered that the bad effect of the fits on the moral condition and general character was much more marked than on the mental condition; three-fourths of the children were thought to be abnormal in moral character. Not much practical information, however, can be derived from many of the statistics which have been published, for they draw no distinction between cases in which there are obvious reasons for moral and intellectual deficiency, quite apart from the occurrence of convulsions; there is, in many such cases, an antecedent cause, which accounts both for mental abnormality and for convulsions; the convulsions are not necessarily the cause of the mental condition; for instance, parental alcoholism and insanity undoubtedly favour the occurrence of mental weakness in the child, and the child, whose brain is sufficiently abnormal to cause mental defect, is likely to have convulsions; it would be at least rash to attribute the mental defect in such a case to the convulsions. It has been estimated (Lapage) that 29 per cent. of feeble-minded children have had convulsions, but certainly, in a considerable proportion, the convulsions are not the cause of the mental defect. McIlraith found 17 cases of mental deficiency, including 9 in which there were obvious signs of cerebral lesion, amongst 250 cases of convulsions. The same observer records that 7 out of 17 children who had suffered from convulsions before two years of age when seen several years after the first attack, seemed to be epileptic, whilst Moon[16] found that 40 per cent. of children with convulsions showed continuance of the attacks, presumably epileptic in nature. These statistics may serve to inculcate caution in prognosis, but probably those who have largest experience of children will take a much more cheerful view of the prospects of infants, who have infantile convulsions, than these figures might seem to convey.

TETANY.

Closely allied to convulsions is the tetany of infants, which our continental neighbours call Spasmophilia. Stoeltzner[17] has recently put forward an interesting hypothesis of the ætiology of tetany. He found that the addition of calcium chloride, or acetate, to the food of infants suffering from tetany, aggravated the symptoms, whereas sodium chloride and magnesium carbonate had no such effect. He considers that tetany is made worse by feeding the infant with cow's milk, and points out that the amount of calcium chloride in cow's milk is five times as great as that in human milk. The association of tetany with rickets he explains by the increased amount of calcium in the blood, owing to failure of bone-calcification by which the calcium should have been utilised. Tetany, in fact, according to Stoeltzner is a form of calcium poisoning, and he combats another view which has been equally gravely propounded, that tetany is due to functional disorder of the parathyroid glands. He says that, after experimental removal of the parathyroids, there is quickness of breathing with tachycardia, somnolence, tremor, and albuminuria, which symptoms he does not find in tetany (albuminuria is commonly observed with tetany in this country), moreover the animals whose parathyroids have been removed are relieved of their symptoms by a milk diet. But "who shall decide when doctors disagree?" for almost at the same time, another observer, Zahorsky,[18] reports that he has not found a single case of "Spasmophilia" among infants fed on fresh, unboiled, cow's milk, and says that he does not hesitate to place cases of "spasmophilia" on cow's milk, provided it is unboiled. Another states that he has never known tetany arise, unless some artificial food had been given.

Finkelstein[19] found that neither casein, fat, nor sugar had any influence on tetany, whereas whey at once aggravated it; he concluded that the *causa malorum* was either the phosphorus or the lime of the milk. Whatever theory is propounded to account for the occurrence of tetany must take into account the striking relation of this disorder to diarrhœa, and other gastro-intestinal disturbances. Stoeltzner states that the intestinal mucosa acts both as absorbent and eliminant of lime-salts, and if an excessive amount is taken into the blood by feeding on cow's milk, and even more if the amount in the blood is increased by failure of lime-utilisation in the formation of bone, as happens in rickets, then the powers of elimination, exercised by the intestinal mucosa, become insufficient to prevent excessive accumulation of the lime in the blood, and tetany results. This, it may be observed, assumes that, while the eliminating function is impaired, the absorbent function is sufficiently active to continue the storage of calcium.

Uffenheimer has recently drawn attention to a peculiar facies, which he considers to be pathognomonic of tetany; the face wears a worried look, like that of a harassed adult; he says it may be present before any other signs of tetany have appeared.

CONGENITAL HEART DISEASE.

The ætiology of congenital heart disease has been under discussion recently. Dr. F. J. Poynton [20] has recorded five cases, in which there was a strong family history of acute rheumatism, and mentions three cases, in which the mother had acute rheumatism whilst pregnant with a child, who proved to have congenital heart disease. He states that he has rarely met with a convincing example of congenital heart disease due to syphilis. Dr. Cautley,[21] on the other hand, has recently stated as his opinion that syphilis is the great cause of this form of heart disease. But probably the experience of most observers would agree in the difficulty of assigning any cause in the large majority of cases of congenital heart disease. Some children with this condition are the children of alcoholic parents, and Dr. Ballantyne, who describes a case, in which alcoholism in the father seemed to be responsible for congenital malformation of the heart in the child, points out that it has been proved experimentally that alcohol passes as alcohol from the maternal to the fœtal circulation.

The great increase in the number of red corpuscles, and in the percentage of hæmoglobin, in cases in which there is cyanosis, has attracted much attention. Bernstein [22] reported a case, in which the red corpuscles numbered 10,600,000 per cub. mm. Poynton refers to Baumholtzer's case, in which with 9,447,000 red cells per c.mm. there was 160 per cent. hæmoglobin. Carpenter records a case in which, with cyanosis, there were 7,880,000 red cells, and the hæmoglobin was 122 per cent. Bernstein's case, a boy, who died, at the age of 2 years and 8 months, with marked cyanosis, and clubbing of fingers and toes, showed curious attacks of coma with feeble irregular pulse, and rapid forcible respirations ; the attacks lasted some hours, and recurred several times during the ten days before death. The heart, in this case, was greatly deformed, the right ventricle was practically absent, and there was a polypoid mass obstructing the entrance to the pulmonary artery.

Swoboda [23] reports a case illustrating a less rare occurrence in congenital heart disease, anginal attacks. This was a cyanosed infant, aged 18 months, who during the last four months of life was seized during, or immediately before, defæcation with severe distress ; he groaned, and then became extremely dyspnœic, the skin became intensely cyanotic, and sometimes the child lost consciousness; the attacks lasted from one to twelve hours, and often ended with vomiting, epistaxis, or cough. During the attacks, the loud systolic bruit, heard at other times all over the pericardium, was lost.

The possibility of antenatal diagnosis of congenital heart disease has again been illustrated by a case recorded by Dr. J. McCrae,[24] of Montreal. A woman, with a harelip, and a systolic cardiac murmur audible widely over her chest, was pregnant, and a fœtal systolic bruit was detected before the birth of the infant, who was found to have a much malformed heart in addition to transposition of viscera.

SPONTANEOUS HÆMORRHAGE IN THE NEWLY-BORN.

Dr. Machell,[25] of Toronto, records 14 cases of this dangerous disorder; 8 out of 13 cases, in which the result is mentioned, were fatal. In all, the bleeding increased gradually after beginning usually before the end of the second day of life. In no case did it begin later than the end of the third day. The site of hæmorrhage varied in different cases; in two it was from the umbilicus, in eight from the bowel, in six from the stomach, in some into the skin, in one into the suprarenal capsules, in one into the abdominal cavity, and usually, Dr. Machell says, the bleeding is from more than one source.

The prognosis is always grave. Dr. Machell thinks that, although a large and sudden hæmorrhage obviously means great danger, the results are not altogether in correspondence with the amount of hæmorrhage. Some cases die when very little blood has been lost. He quotes Abt's statement that the loss of blood should no more be considered the cause of the fatal result in these cases than would the purpuric spots in purpura hæmorrhagica, or in cerebro-spinal meningitis. In some of the cases, he attributes the fatal result to sepsis or toxæmia. Statistics have shown a mortality of 79 per cent. (Townsend).

On the other hand, the danger appears to be an immediate one. If the infant recovers from this hæmorrhage there is no special tendency to bleed when it is older. Circumcision has been done on the eighth day in an infant who had recovered from spontaneous hæmorrhage during the first few days of life (Rotch).

The hæmorrhage, therefore, is obviously not due to hæmophilia, but Machell points out that hæmophilic bleeding in the new-born is not unknown, so that, in advising as to circumcision, and in giving prognosis as to the child's future, one can only be guided by probabilities. Spontaneous hæmorrhage in the newly-born is very much commoner apart from hæmophilia than with it; hence, apart from a family history of hæmophilia, it will probably be quite safe to regard the case as not hæmophilic. In view of the statements that have been made as to the frequency of syphilis in these cases, it is interesting to note that not one of Dr. Machell's series showed any evidence of syphilis in child or parent.

The treatment of spontaneous hæmorrhage in the new-born is a matter of difficulty, for too often the ordinary remedies for hæmorrhages have little or no effect.

Adrenalin chloride solution (1 in 1,000), given by mouth, in doses of five drops every four hours, was successful in a case in which the hæmorrhage was from the stomach (Tuttle). The administration of saccharated extract of suprarenal, suspended in water, a grain every hour, was followed by recovery in an infant with hæmatemesis and subcutaneous hæmorrhages (Holt). Calcium chloride was given in several of Machell's cases (a grain every four hours is mentioned as the dose in one case), apparently with little or no benefit.

The gelatin treatment has been much lauded in recent years; for instance, Holtschmidt reported five consecutive cases treated successfully with hypodermic injections of a 2 per cent. solution of gelatin. But it has been shown since that there is a risk of severe toxic symptoms, if not of tetanus, from the subcutaneous use of gelatin, and it seems much preferable to use it, as others have done, by mouth.

Dr. Machell used a solution made thus:—℞.: Gelatin. Alb. (Merck.), gr. xxx.; Sod. Chloride, gr. ij.; Aq. distill., ℥iij. One drachm to be given by mouth every hour or two hours. This formula, taken from Frühwald, was taken well, and was followed by improvement in one case. He mentions also a case in which a boy, aged 10 years, with hæmophilia and epistaxis, ceased to bleed, after taking drachm doses of a 2 per cent. solution of gelatin every hour for a few hours; and 24–36 hours later it was found that not even the few drops of blood required for a blood examination could be obtained with the usual ease from the ear or finger, whereas previously the boy had bled on the slightest provocation.

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INFANT MORTALITY AND FLY INFECTION.

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SEEING that infant mortality is rightly engrossing the attention of all those interested in the welfare of the State, I take it that, in the present state of our knowledge as to its cause, any particulars, which throw further light on the subject, or assist us in combating this national disaster, must be of value.

There is no doubt that feeding plays a very important part in the production of this mortality, for it is an undisputed fact that the artificially-fed infant runs a far greater risk from all causes than one fed naturally. This is particularly the case when we consider diarrhœal diseases in the summer and autumn months. Dr. Hope states that, during these months, fifteen times as many bottle-fed infants die as those fed on breast-milk.

In the May number of THE PRACTITIONER for 1906, Dr. Nash, Medical Officer of Health for Southend, points out the very important part played by the common house-fly in the production of summer diarrhœa.

The spread of this disease by this means has not, I think, received sufficient attention, and it is with this object in view that I venture to give particulars of two cases which have come under my immediate notice, and further, to briefly point out the means which we might adopt in order to prevent this infection.

Case 1.—A child, aged 5 months, living in a bungalow situated on the top of a hill, quite isolated except for a farm house some 200 yards distant, surrounded by open country, became infected, and died, within 36 hours from the onset, of summer diarrhœa. The only other occupants of the house were the parents and two other children, all of whom were healthy. There was no overcrowding. The infant was to the best of my belief entirely breast-fed, and had done well from birth. The number of flies in this house was extraordinary, and was attributed by the people to the manure in the neighbouring farmyard.

Case 2.—This infant, 6 months old, which also died, was living in a short row of cottages, the only buildings in that part. As in the former case, there was no overcrowding, and the child was breast-fed. In this instance, I had occasion to visit at the house previous to the child's illness, and observed the mother nursing while the flies were crawling over her breasts and around the child's mouth. To this I drew her attention. At the same time, I noticed that the walls and ceilings were covered with flies. This condition prevailed throughout this row of cottages, and was, I believe, mainly due to a manure heap some 80 yards distant.

I have very little doubt that these children became infected by means of the flies, as I could find no other cause to account for their illness. Having regard to the infection, or possibility of infection, of breast-fed infants by this means, too much importance cannot be attached to the cleansing of the breasts before suckling, together with the protection of the child's face, at all times, from flies. It is not an unusual sight, among the poorer classes, to see a mother proceed to suckle her infant, or at any rate to "give it the breast," at any moment that it may seem restless, whether in the road, train, or tramcar. There is not the slightest effort made at cleansing the breast, nor is such a course possible. That the child's face should be protected from these creatures by a piece of fine muslin seems a procedure which any mother, however poor, might carry out. Though simple, it is very rarely seen nowadays, the fashion of veiling a baby's face having gone out. Maternity nurses and health visitors are the chief persons by whom these instructions can be given to the mothers.

In further support of the theory that flies are instrumental in the production of this disease, I would like to draw attention to two facts which were observed during the summer of 1906, in the Orsett district, in which the cases, to which I have referred, occurred.

(*a*) The house-fly appeared late, and remained until late in the autumn; flies were very, almost exceptionally, numerous.

(*b*) Diarrhœal diseases accounted for over 39 per cent. of deaths under one year, and these deaths occurred in August and September, the number in the latter month being equal to that in August, while no deaths were registered in the earlier summer months.

If it is true, as I believe it to be, that fly infection is a great factor in the production of this disease, we can readily appreciate the greater risks run by the infant which is artificially fed.

Our great object should, therefore, be to induce mothers, by every possible means, to suckle their young.

At a recent meeting of the Sanitary Institute, it was stated that 50 per cent. of mothers were physically incapable of nursing their babies. Professor Spencer states that 75 per cent. of mothers are able to suckle their children.

Of those who do not nurse their young, ignorance and laziness account for a certain proportion. Want of proper nourishment on the part of the mother is, in many instances, a fruitful cause.

In the future, we may look to education in the matter of hygiene to make such a cause as ignorance impossible. Want of nutrition, on the part of the mother, can only be effectively dealt with in one way, and that is by feeding the mother. Whether this should be undertaken by the State, or by philanthropic enterprise, is not within the scope of this paper to consider, but that some effort in this direction should be attempted is beyond question most desirable. A healthy child, born of healthy parents, and nourished according to the law of nature, is a great asset to the nation, and is one which, in its turn, is far more likely to produce and nurture a healthy offspring.

There will, however, always remain a certain number ot mothers who are unable to nurse their children, and it is to these children that the fly is such a deadly foe.

Municipal depôts for the supply of milk exist only in a very small number of the large towns, and it must not be forgotten that sterilised milk, in the hands of the ignorant and careless, may become a source of infection after it reaches the home. Food, however carefully prepared, if it afterwards becomes contaminated, is just as injurious, just as poisonous, as what is unprepared and unsuitable.

During the summer, in most of the dwellings of the poorer classes, flies abound, and any food, for a moment exposed, is immediately covered with them. It is not an unusual thing for a woman to remove dead flies from the milk which she has put aside for the infant's bottle.

At present, nothing is done directly to remove or prevent the annual recurrence of these pests. The results of the war against the mosquito in the prevention of malaria have been great, and I look forward to the day when our efforts will be directed in a similar manner against the fly.

As I have previously stated, properly prepared milk is only obtainable in a few towns, and even this milk, as pointed out by Dr. Sutherland in his book on "Treatment of Disease in Children," is not without its own particular dangers, since it sometimes causes rickets, scurvy, and allied diseases.

Let me here quote Dr. Newman, who says: "It cannot be too clearly understood that sterilisation does not make bad milk good, or dirty milk clean."

Dr. Collingridge, in his report on the milk supply to London, states that the percentage of dirty milk which arrives in London is over 50 per cent., and it seems highly probable that many towns would show as bad a record as, if not worse than, the metropolis. It is therefore obvious that we must begin by improving our milk supply.

In Dr. Nash's paper, referred to above, he points out that the fly is the conveying "organ," and that the organism which the fly conveys causing the disease is derived from manure heaps and such like accumulations.

If we consider the average cow-house, I doubt if we could find a more suitable site for the production of both organ and organisms. Here it is that we should see that there should be the least possible chance of contamination. In the neighbourhood of the cow-house there exists, as a rule, a large collection of manure, not only outside, but also inside the house. The difficulty of enforcing the regulations with respect to the cleansing of the floors is well known to those who have to inspect them, and the idea of a clean floor is, in many cases, looked upon as a mere crank of the official. Cows, we are told, slip on clean floors, serious injury being the result, possibly causing, in many cases, the loss of the cow. As a general rule, the cow-keeper's idea, if he has one, of an organism is an animal much too large to pass through his strainer.

I can at present see only two possible ways of improving these conditions to any extent, and I would suggest that the first is worthy of consideration in all towns.

1. A series of lectures to all cow-keepers should be given by a competent veterinary surgeon, who would instruct them in the care of the cow generally, laying stress on the importance of scrupulous cleanliness, impressing upon them that the washing of udders is not injurious to the cows, etc., etc., and further pointing out how they may detect tuberculosis and other diseased conditions. These lectures might well be followed by a series from the M.O.H. on diseases conveyed by milk, the way in which they are produced, and the means by which they are spread. In this way, I think that we might, in time, have the keeping of cows and their milking carried out under scientific principles.

2. The complete control of all cow-sheds by the municipal authorities. In a short time, I have little doubt that the outlay, which at first would be considerable, would bring in a very satisfactory dividend to the authority bold enough to adopt such a procedure.

In the meantime, one very urgent matter calls for immediate legislation, that is, the prohibition of the exposure, in shop windows and elsewhere, of all articles of food, especially milk. Milk should be delivered, in sealed cans direct from the place where the cows are milked, to the dairy where it is to be sold. A tap would enable the vendor to retail the supply in smaller quantities. At present, food in general is set forth to entice the buyer, and, at the same time, it attracts the omnipresent fly, which has possibly just left a tuberculous mass expectorated on the pavement. Apart from this revolting but truthful picture of the harmful fly, much disease may be conveyed to exposed food by dust borne on the wings of every prevailing wind.

NOTES FROM FOREIGN JOURNALS.

TREATMENT OF CATARRHAL PHARYNGITIS.

The *Revue internationale de médecine et de chirurgie* points out that the following prescriptions are of use in acute attacks of pharyngitis. The patient must gargle gently, slowly, and for some time either with barley-water, marshmallow decoction sweetened with honey, or with a salicylic solution :—

℞.	Sod. Salicyl.	ʒj.
	Syrup. Rhœados.	℥j.
	Decoct. Althææ	ad ℥viij. M.

As soon as the inflammation has subsided a little, slightly astringent preparations, such as the following, can be used :—

℞.	Sod. Biborat.	gr. xlv.
	Tinct. Benzoin.	ʒiij.
	Syrup. Mori	℥iss.
	Aq.	ad ℥viij. M.

After all inflammation has gone the patient will obtain much benefit and relief from the application of—

℞.	Sod. Biborat.	gr. xlv.
	Glycerini	℥j. M.

Acute attacks, however, are, as a rule, incidental to a chronic affection, and this must be taken in hand when the acute attack has passed off. Topical applications of a more energetic nature are required, the most efficient being resorcine, iodine, and chloride of zinc.

℞.	Sod. Biborat.	gr. xlv.
	Resorcin.	gr. xxx.
	Glycerini	℥ss.
	Aq. Menth. Pip.	ad ʒvj. M.
or ℞.	Iodi	gr. v.
	Potass. Iodidi	gr. xxx.
	Menthol.	gr. iiss.
	Glycerini	℥j. M.

The effect of these applications can be increased by using gargles.

℞.	Acid. Carbolici	♏iij.
	Resorcin.	gr. xv.
	Glycerini	℥j.
	Aq. Menth. Pip.	℥iss.
	Aq.	ad ℥viij. M.

Chloride of zinc is most useful in the chronic hypertrophy variety (granular sore throat, chronic pharyngeal tonsillitis). The application must always be made by a medical man, with a light touch, and only at intervals.

℞.	Cocain. Hydrochlor.	gr. iv.
	Zinci Chloridi	gr. xv.
	Glycerini	ʒiss.
	Aq. destill.	ad ℥j. M.

TREATMENT OF BURNS.

The June number of the *Therapeutic Gazette* contains a symposium on this subject, the contributors to which are surgeons of experience in mining and iron-foundry districts, where many and various kinds of burns are of daily occurrence.

W. L. Estes considers that systemic treatment is fully as important as local, and is, as a rule, the first indication, for every considerable burn is immediately followed by shock. External heat must be applied by hot-water bottles wherever practicable, hot drinks of lemonade, or black coffee, given by the mouth, and rectal infusions of hot saline solution administered, or, if appropriate regions are available, hypodermoclysis with normal salt solution. A full dose of morphia relieves the pain and anxiety, and, at the same time, relaxes vaso-motor spasm. Before applying any permanent dressings, the condition of the heart and lungs must be ascertained, for the proper performance of a dressing is necessarily tedious, and, if the possibility of great weakness is not borne in mind, the zealous aseptician may find his patient dead before the dressing is finished. If soiled coverings have been placed over the burns, they must be washed gently with 2 per cent. solution of carbolic acid, or 1 per cent. creolin suspension, followed by normal salt solution. Warm alkaline lotions are used for the first permanent dressing, such as 1 per cent. solution of bicarbonate of potash or soda, 2 per cent. solution of borax, or, in case of need, normal salt solution. Large burns should be dressed piecemeal, so as not to expose the whole surface at once. After cutting away clothing, etc., cover the whole with a temporary gauze dressing, wetted in the warm alkaline solution, and proceed, section by section, cleansing, and dressing. Superficial burns do well treated with gauze wrung out with 1 per cent. solution of picric acid and applied directly to the burn. All blebs and blisters should be snipped at the most dependent spot, but the epidermis must be carefully preserved. Another useful application for these is a powder of equal parts of boric acid and subnitrate of bismuth, which is sprinkled over the burn, and covered with gauze having a thick layer of sterile vaseline spread over it. Outside is placed a thick layer of wool, and a bandage is firmly but not tightly applied. For deep burns the best application is sterile gutta-percha tissue, outside of which is a thick moist aseptic dressing. When a hard tough slough forms, multiple small incisions should be made through it down to living tissue, relieving tension and allowing more thorough disinfection. Salicylic acid is an useful disinfectant and deodoriser for this class of case. No oils or fats should be used, except sterile vaseline, as they cannot be kept from decomposing. Ichthyol and Peruvian balsam in 5 per cent. solution are the best means of prevention, but not certain. If cases are treated by the open method—a very good way—care must be taken to screen off all flies.

W. Lathrop condemns the use of carron oil, and uses picric acid in the first instance for all burns, applying picric acid gauze, and covering with plain gauze, wool, and bandage. If picric acid solution is used, he prefers lint to gauze for application. If the burns are not deep, he continues the picric acid treatment until healing takes places, but, for deep burns, he applies, after four or five days, soft paraffin spread on lint, washing the surface at each dressing with 1 : 20 carbolic lotion after spraying with peroxide of hydrogen. In obstinate or slowly healing cases, he applies a mixture of ichthyol, balsam of Peru, and vaseline, and, if this fails, he uses resin ointment. The last-named he believes to be far more effective than any method of skin-grafting. For shock, he prefers a preparation of ergot called "ergone," giving ♏xxv. subcutaneously every hour for four hours. Thirst is relieved by enemata of salt solution, and by draughts of hot water, or black coffee. For explosion cases, he uses 1 : 20 carbolic lotion and gauze packing.

A. W. Urmson uses picric acid solution for dressing, and washing burns of the first and second degrees, punctures all blisters, and leaves the dressing (gauze and wool) on for two days. It is moistened and removed by the use of picric acid solution. The staining of the hands incidental to this method can be removed by washing them in alcohol immediately after the dressing. Burns of the third degree are treated with picric acid for twenty-fours, then with some sterile powder, such as aristol. If any suppuration occurs, the wound is sprayed with peroxide of hydrogen, and irrigated with normal saline, before the powder and gauze dressing is renewed. Burns with deep sloughing and great destruction of tissue are treated in sublimate baths 1 : 12,000, at 37° to 38° C. Large surfaces are grafted.

The "open method" is suitable for burns of the first and second degrees, if treated in hospital.

J. E. Cannaday cleans with normal saline, and applies soft paraffin and light gauze dressing. This is changed daily for three weeks, when the surfaces are ready for grafting. In order to obtain a healthy granulating surface for this purpose, he uses dressings of gauze, wetted in lotio chloral. hydrat. (gr. ij. in ℥j.), covered with oiled silk, and changed twice a day. For some cases, he prefers the "open method." J. C. Biddle (Fountain Springs, Pa.) has tried all other methods, but prefers, and adheres to, the following, which has given him excellent results for twenty-three years:—

℞. Plumbi Carb. - - - - -	℥xvi.
Pulv. Acaciæ - - - - -	℥vi.
Sodii Bicarb. - - - - -	ʒiij.
Ol. Lini - - - - - -	q.s. M.

To make a thick creamy paste, which is spread on lint or Canton flannel. This is cut into strips and applied, after all blisters have been snipped, all shreds, etc. removed, and the parts washed with soap and water as thoroughly as possible. The first dressing is left on until the outer covering of wool is soaked through by the secretion. Frequent dressings he considers meddlesome. He has never observed lead-poisoning, so long as the acacia is included in the preparation. Shock is treated with strychnine gr. $\frac{1}{20}$th or $\frac{1}{30}$th hypodermically, and ℥xij.–xv. of normal saline by hypodermoclysis, every six or eight hours.

J. H. Swaving first ascertains the general condition by noting the temperature, pulse, and respirations, which reveal the amount of shock present. If this is severe, local treatment is deferred until the patient is restored. He dresses the burns piecemeal so as to avoid exposure, washing with warm boracic lotion, salt solution, or sterile water. He applies three to five layers of gauze strips, wrung out of a saturated solution of picric acid, covers with plently of wool, and allows the dressing to remain for from two to five days. The picric acid treatment is continued until all sloughing ceases, and is then replaced by an ointment composed of equal parts of zinc ointment, ointment of formic iodide of bismuth, and soft paraffin.

TREATMENT OF CHRONIC ENTERITIS BY MEDLARS.

In the *Archives de médecine navale*, Mercier records a method of treatment which has proved successful on himself and several other patients treated at Lorient. The effects of the treatment are pretty well constant, whatever may be the particular variety of the disease present, and however long it may have lasted, always provided that it is not an attack of acute dysentery. Three or four days after taking the medlars, the stools became formed, and maintained this character until the patients left the hospital. In colour they resembled that of the fruit. If, during the treatment, the stools began to get loose in consequence of too liberal a diet, a few days' restricted diet restored the normal condition of things. The patient is given 2 litres of milk and 230 g. of medlars in the 24 hours. The fruit must be peeled, the stones taken out, and it must not be over-ripe (soft). As soon as the stools become normal, the diet is gradually increased after the following scale:—Raw eggs, *crème de riz*, fish, sweetbread, brains, chicken, beefsteak, bread, milk for beverage. Should an acute dysenteric crisis supervene (bloody mucous or simple mucous stools), the ordinary treatment by ipecacuanha, or sulphate of soda, must be adopted, only resuming the medlars when the stools become loose, as in an ordinary diarrhœa. The results are constant and speedy. Constipation is never caused; in fact, the patients will often pass two properly formed motions a day. Previous constipation is corrected. As the medlar season only lasts from November to January, means have been found for preserving them, so that the treatment can be kept up all the year round. The preserve is rather less efficient than the fresh fruit. Mercier's recipe for preserving is as follows:—

Medlars - - - - - -	1 kilo.
Sugar - - - - - -	800 grammes.
Water - - - - - -	½ litre.

Boil for three-quarters of an hour, and then put them into bottles, which can be hermetically sealed.

FORMIC ALDEHYDE DISINFECTION BY MEANS OF PERMANGANATE OF POTASH.

E. M. Houghton and L. T. Clark publish, in the *Therapeutic Gazette*, July 1907, the results of their experiments on this method of liberating formic aldehyde from aqueous solution. This vapour has been recognised as the most efficient germicide available for disinfecting rooms, but there has always been a difficulty in devising a safe, economical, and effective method for obtaining the gas from solutions or from its dry polymeric form, which would not require expensive apparatus and a skilled operator. There are several methods now in use, but those which are the most efficient require outside heat, as well as the accessories mentioned above.

G. F. Johnson first drew attention, in January 1904, to a new means of obtaining the gas, without external heat, by the simple addition of permanganate crystals to formaldehyde solution (full-strength). Since the appearance of this paper, many experiments have been made for the purpose of determining the relative proportions of each which will yield the best effect. McClintic reported that the best results are obtained from a proportion of 50 grammes of permanganate of potash, in crystals, and 100 c.c. of formaldehyde. Within a few seconds to a minute, according to the size of the crystals and the temperature of the room, vigorous ebullition occurs, and sufficient heat is produced to set free a large volume of formic aldehyde and aqueous vapour. The boiling continues for about six minutes, and gradually subsides, leaving nothing but a small residue, which is nearly dry, and is composed of a lower oxide of manganese, a very small amount of formaldehyde, carbonic acid, hydrate of potash, and a little moisture. The amount of formic aldehyde, destroyed in the process, is very small. In practice, it is found that from the ordinary 40 per cent. solution of formic aldehyde, 38 per cent. can be obtained by the autoclave, and $33\frac{1}{3}$ per cent. by the permanganate method. This small advantage is more than counterbalanced by the rapid liberation of the gas, which makes for very thorough disinfection.

Working on the formula, as established by McClintic, of the chemical decomposition taking place, Houghton and Clark found that when 240 grammes, just over 8 ounces avoirdupois, of crystals of permanganate of potash were placed in an ordinary three-gallon pail, and 480 c.c., or 17 fluid ounces of formol, poured on to them, sufficient gas was evolved to disinfect 1,600 cubic feet of space. The ebullition set up, being very violent, and occasioning much foaming and spattering over the pail, the authors tried various experiments to retard the reaction sufficiently in order to do away with this disadvantage, and eventually succeeded, by mixing the crystals with 15 per cent. of Portland cement and enough water to give sufficient consistency for making small blocks. After making, these "briquettes" are left to dry, and can then be readily handled. With the crystals in this compact form, the method is quite simple. The charge of formaldehyde is poured into the pail, and three briquettes, each containing 80 grammes of permanganate crystals, are dropped into the liquid. The reaction is slower and less violent. The author claims that formic aldehyde disinfection is simply and quickly accomplished by means of the permanganate briquettes; that no expensive apparatus is necessary, and no outside heat is employed, thus lessening the danger of fire; more thorough disinfection is accomplished, because the whole volume of gas and moisture is liberated during a very short time. The usual sealing-up of the room is necessary, and the operator must leave the room directly the permanganate is put into the liquid.

TREATMENT OF GALL-STONES.

C. G. Davis, in the *Therapeutic Gazette*, has a short article, with illustrative cases, on the treatment of "catarrhal cholangitis and its congeners." After a long experience, he is of opinion that by suitable treatment with certain drugs, operative measures may be entirely avoided. He has, for some years, been using salicylic acid, and its satisfactory effect may be increased by combination with others, which have a cholagogue and antiseptic effect. He has had the best results from the use of:—

℞. Phenolphthalein - - - - - gr. $\frac{1}{3}$
Sodii Oleat. Acid - - - - - gr. i.
Acid. Salicyl. pur. - - - - - gr. iss.
Menthol - - - - - - gr. i.
Misce. Fiat pilula.

The salicylic acid must be the "true" acid, obtained from natural sources, and not synthetically, and the acid sodium oleate must be prepared with care. This combination is used, not as a purgative, but as a cholagogue, a solvent of concretions, and a biliary disinfectant. Menthol and phenolphthalein act by promoting intestinal activity, the salicylic and oleic acids as disinfectants, the latter also being a powerful cholagogue. Two pills are given night and morning followed by a glassful of hot water. If this dose is insufficient, two pills should be given two hours after each meal, with the glass of hot water. Taking plenty of hot water is an integral part of the treatment. Diet is not very closely restricted ; all foods difficult of digestion and alcoholic beverages are forbidden.

THE USE OF ADRENALIN DURING ETHER ANÆSTHESIA.

In the *Virginia Medical Monthly*, Venable relates an experience in giving ether, in which he met with more trouble from profuse bronchorrhœa than ever before. Breathing was so much obstructed by the mucus, that at times the respirations ceased. After trying various remedies the pharynx was mopped out with a 5 per cent. solution of adrenalin. Matters at once improved, less mucus was secreted, and respiration was clear. Another application was made, when the mucus threatened to return, and after this a few drops of the adrenalin solution were poured now and again into the ether cone, with the result that the anæsthesia was carried out quite successfully. After this experience Venable determined to use adrenalin as a routine in a series of cases. He found that the best results were obtained by using a 25 per cent. solution of the standard 1 per 1,000. This is sprayed on to the cone, after the ether has been poured into it. An interval of three to six minutes is sufficient, and half an ounce to one ounce of the solution is enough for an operation, lasting from thirty minutes to one hour. He claims to obtain more regular ether effect, steadier pulse, which is also slower, and of a better character than under ether alone ; the respirations are quiet and regular, and the bronchial secretion is checked. Recovery from the anæsthesia was uniformly good ; only two patients vomited. Venable concludes that, as the bronchial glands secrete less mucus, there is better aëration of the bronchioles and pulmonary vesicles, less ether is required to produce anæsthesia, and there is less chance of pneumonia following.

ACTION OF THIOSINAMINE UPON CARDIO-VASCULAR FIBROSIS.

Louis Rénon, in the *Journal des Praticiens*, reports the results of the use of thiosinamine, after some years' experience, in the treatment of cardio-vascular fibrosis, valvular affections, pericardial adhesions, and arterio-sclerosis. Last year, in a communication on the same subject, he was convinced of the use of this substance in mitral and aortic stenosis. He had been using a simple watery solution of 15 grains in 1 oz. of sterilised distilled water, injecting 1 c.c. of this under the skin of the abdomen for two days, then 2 c.c., and, on the following days, 3 c.c. These injections produced no pain or local reaction, as is the case with a solution in alcohol or glycerine. He has since modified his technique somewhat, and continued his observations. In mitral affections no appreciable effect has been noted, either in cases of stenosis or of insufficiency ; the heart-lesion was neither improved nor aggravated. It was a different matter with aortic affections. In chronic aortitis with systolic murmur, or with a double murmur, and in both stenosis and insufficiency, a constant effect was obtained in the decrease of dyspnœa. Patients who could neither walk upstairs nor carry a heavy weight have been able to perform these acts, without any feeling of oppression. The arterial tension, measured by Potain's sphygmomanometer, fell 2, 3, 4, and 5 cm. of mercury. Albuminuria was diminished or disappeared, and the quantity of urine increased. On the other hand, the auscultatory symptoms remained unchanged. Rénon has never observed the decrease of murmur, nor even a difference in the intensity before and after treatment. The improvement, however, cannot be attributed to rest and appropriate feeding, for patients taking ordinary food and carrying on their usual work have shown the same effects from treatment. In a case of adherent pericardium with mediastinal inflammation, the exhibition of thiosinamine twice with an interval of two years brought about a considerable improvement in the dyspnœa, without any appreciable alteration in the physical signs. Combe reports a similar result with fibrolysin, in a child of ten years of age, suffering from pericardial adhesion with fibroid degeneration of the heart, and ascites. The effect in arterio-sclerosis was less constant, in some cases tension was lessened and dyspnœa improved, but in others no result was noted. In every case, which has benefited from the use of thiosinamine, the effect of the treatment has been prolonged after administration has ceased. The time has varied from 3 weeks to 4 or 5 months. Rénon uses pure French thiosinamine dissolved in water, without the addition of antipyrine or salicylate of soda. German thiosinamine is insoluble, or nearly so, in water. The solution employed is:—

℞. Thiosinamine - - - - - - 1 gramme.
Sterilised distilled water - - - - 25 c.c.

One c.c. of this solution contains 4 c.g. of thiosinamine. An injection of 5 c.c. (20 c.g. of the substance) is given every day for from 25 to 30 days, in the flanks, or the upper part of the buttocks. They are not painful, and for the most part produce no induration. The distilled water may be replaced by sterilised normal salt-solution, but the solution therein of the thiosinamine must be made in the cold. If hot water is used, decomposition takes place, especially with soluble thiosinamine, which is the least stable form.

APPLICATION FOR WARTS.

Mantelin and others report successful results from the use of the following:—

℞. Chloralis Hydratis - - - - - gr. xv.
Acidi Acetici - - - - - m. xv.
Acidi Salicylici - - - - - ʒj.
Ætheris - - - - - - ʒj.
Collodii - - - - - - ℥ss.
Misce. Fiat collodium.

To be applied to each wart every day until it disappears.

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Reviews of Books.

Climatotherapy and Balneotherapy. The Climates and Mineral Water Health Resorts (Spas) of Europe and North Africa, including the General Principles of Climatotherapy and Balneotherapy, and Hints as to the Employment of various Physical and Dietetic Methods. By Sir HERMANN WEBER, M.D., F.R.C.P., Consulting Physician to the German Hospital, London, etc.; and F. PARKES WEBER, M.D., F.R.C.P., Physician to the German Hospital, London, etc. Pp. 833. London: Smith, Elder & Co. 15s. net.

THIS valuable and comprehensive treatise is a compilation of all the best known facts bearing upon its subject-matter. For clearness and convenience, it is divided into three parts. The first opens up with a very useful dissertation on medical climatology, and then deals very fully with the climatic health resorts of Europe and North Africa, not omitting the Ocean as a health resort. The second discusses the general subjects of hydrotherapy and balneotherapy, and describes the various mineral-water health resorts; while the third is devoted to the indications for treatment, the use and selection of climates, mineral waters, and health resorts in chronic diseases and morbid conditions, with hints as to the employment of various physical and dietetic methods. There is an exceedingly useful bibliography, and a copious index. As a work of reference for the subjects on which it treats, it would be almost impossible to find its equal.

Surgery of the Rectum. By H. W. C. WALLIS, B.A., M.D., B.C. Cantab., F.R.C.S., Surgeon to Charing Cross Hospital, St. Mark's Hospital, and the Grosvenor Hospital for Women and Children. London: Baillière, Tindall & Cox. 2s. 6d. cloth; 2s. paper.

IN compiling this short work, the author's aim has been to present the surgery of the rectum of the present day, in a practical and condensed form, to young surgeons and practitioners, and his long experience in rectal diseases entitles him to speak with authority on the subject, and freely justifies him in writing dogmatically on certain points.

The first few chapters contain the author's original ideas on the inflammatory affections in and around the rectum, including the ætiology of pruritus ani. In dealing with the treatment of fistulæ, due to tubercle, we read "the first essential in the question of operation is that no general anæsthetic shall be given." Mr. Wallis then describes how, under local anæsthesia, he treats such cases. We venture to question whether this should be so definitely stated as a general rule, and also to ask whether a thorough and radical treatment of the local condition can be performed under local anæsthesia.

In the treatment of hæmorrhoids, the author describes two operations only, viz., ligature and excision. We read: "recurrence is not an unusual thing after an operation by ligature," and later, "the only radical treatment for hæmorrhoids is excision of that part of the mucous membrane known as the *pile-bearing area*." We are not at all convinced that recurrence after ligature is at all common, and we should like to hear stated what is the "pile-bearing area."

The clinical features of the new growths of the rectum are briefly given, and also a brief description of the various methods adopted for the removal of the same. A chapter is devoted to colotomy. The author describes, with good illustrations, his method of performing this operation. He opens the bowel at once, and ties in a tube. He then goes on to say that when the colotomy is required permanently, it is better to divide the bowel completely across, and tie a tube in each end. Surely such cases are the more numerous, and we are not told the best method of performing this modification of the operation. In connection with this, we read that, "in cases of excessive distension of the colon, or when the mesocolon is short, it may not be possible to deliver the colon outside the incision . . .

"Under such circumstances, the colon is left alone, and a loop of distended intestine, as near the cæcum as possible, is brought out and incised. By this means the large bowel is emptied.

"When the colon is sufficiently emptied, the opening in the small intestine is sewn up, and then the operation of colotomy is proceeded with."

There are many points for criticism in this method of treatment. If the colon cannot be delivered on account of a short mesocolon, what can possibly be gained by incising a piece of small intestine and sewing it up again? And how are we to proceed with the colotomy, when the cause of the difficulty, the short mesocolon, has not been overcome? We are not told in any way how to deal with this. If the colon cannot be delivered on account of excessive distension, will it be possible to elect a certain piece of intestine, and empty that, and if so, what will be gained by so doing? Is it possible to empty the large into the small intestine? We regret that the complications during and after the performance of a colotomy are not more fully dealt with.

Notwithstanding these criticisms, we recommend the book as a practical short treatise on the more common ailments of the rectum.

Gall-stones and Diseases of the Bile-ducts. By J. Bland-Sutton, F.R.C.S., Surgeon and Lecturer on Surgery to the Middlesex Hospital, etc. Pp. 233. London: James Nisbet & Co., Ltd. 3s. 6d. net.

This little book consists of a series of lectures, which have been delivered by Mr. Bland-Sutton at the Middlesex Hospital. We have read it with much pleasure and considerable benefit, and think that Mr. Bland-Sutton's easy and concise style, and apt method of teaching, will be much appreciated by those who have opportunity for reading it. It is without doubt one of the most useful works upon the subject of gall-stones. There are forty-seven illustrations, all of which are excellent, and, at the end of each chapter, there is an extremely useful list of references, which very materially add to the value of the book. It should be carefully read by all medical practitioners.

The Sigmoidoscope. A Clinical Handbook on the Examination of the Rectum and Pelvic Colon. By P. LOCKHART MUMMERY, B.C., F.R.C.S., Hon. Surgeon to King Edward VII. Hospital for Officers; Assistant Surgeon to St. Mark's Hospital for Fistula and Diseases of the Rectum, etc. Pp. 86 and Index. 19 figures. London: Baillière, Tindall & Cox. 3s. 6d. net.

THIS little book, on the inspection of the lower bowel by means of the sigmoidoscope, appears at a time when the importance of this method of examination is becoming increasingly evident. The volume contains a short account of the instrument, the method of its introduction, and the precautions to be adopted in its use. Then follows a selection of cases from the author's case books, illustrating the clinical application of the method. The figures, which illustrate the various diseases, are well drawn and natural in appearance. The diseases described and illustrated include cancer of the rectum and sigmoid flexure, catarrhal and inflammatory conditions of the rectum and pelvic colon, and colitis. The book will give valuable assistance to those who have to deal with diseases affecting the lower bowel. We cordially recommend its perusal.

Cancer of the Breast and its Operative Treatment. By W. SAMPSON HANDLEY, Hunterian Professor of Surgery and Pathology in the Royal College of Surgeons of England; Assistant Surgeon to the Middlesex Hospital; late Surgeon to Out-patients, Samaritan Free Hospital for Women. London: John Murray. 12s. 6d. net.

THE greater part of the book deals with the method of spread of breast cancer. The first chapter points out the inadequacy of the embolic theory to account for the spread of cancer of the breast. The several following chapters are devoted to describing the mode of spread, which Mr. Handley believes to be by far the most common method. These chapters contain a very interesting account of the author's original work, which is enormous. It is most carefully described and written in a most convincing manner. Mr. Handley's conclusions are that, although he does not deny that cancer may spread by the blood stream, the main method of dissemination is by means of lymphatics. The nodules in [the skin, deposits in bones, and visceral growths are explained by Mr. Handley by lymphatic permeation. The work is richly illustrated with excellent diagrams. Some parts seem to us perhaps a little theoretical, but, on the whole, we regard the work as a practical outcome of a most laborious and painstaking work of pathology.

The aim of the work is to put the operation for cancer of the breast upon a sound basis, the author holding that hitherto this operation has been, in some respects, empirical. Mr. Handley describes his operation based upon the results of his work. The main differences which we note in this operation are, first, the skin incisions, which are planned to give as free and painless a movement of the arm as is possible afterwards. Secondly, the author advocates a more extensive removal of deep fascia and muscles than is practised by many. To enable the surgeon to remove the fascial lymphatic plexus widely, it is recommended to remove portions of the external oblique Serratus magnus muscles. The third feature of the operation, which we should comment upon, is the removal of this lymphatic plexus in a downward direction. Mr. Handley is led to believe, from his researches, that the abdomen often becomes invaded by a direct spread of cancer cells through the deep fascia and muscles in the epigastric angle. Particular care is therefore laid upon the removal of tissue in this region.

It is early days yet to say whether this more extensive operation will limit the recurrences after operation for breast cancer, but it is founded on sound pathological study, and we have therefore every reason to hope that it may do so. We regard the book as one which should be carefully studied by anyone interested in the subject, that is, by every practical surgeon.

The Pathology of the Eye. By J. HERBERT PARSONS, B.S., D.Sc., F.R.C.S., Assistant Ophthalmic Surgeon, University College Hospital; Assistant Surgeon, Royal London Ophthalmic Hospital; Ophthalmic Surgeon, Hospital for Sick Children, Great Ormond Street. Vol. III., Part I., pp. 771–1128. London: Hodder & Stoughton. 15s. net.

THE present volume deals in a masterly manner with part of the General Pathology of the Eye. The subjects discussed are the congenital abnormalities, ametropia, the general circulation and nutrition of the eyeball, the normal intra-ocular pressure and experiments connected therewith, and glaucoma. There is also a useful chapter devoted to the theory of immunity. The book has been compiled with great care, and its preparation has involved an immense amount of work on the part of the author, who is to be congratulated upon the success of his efforts, for the present volume will doubtless be as useful and popular as its predecessors.

Catarrhal Fevers, commonly called Colds. By E. PROSSER WHITE, M.D. Pp. viii + 111. London: H. K. Lewis. 4s.

THE old order changeth, and the fetish of contracting a catarrhal fever directly from the chilling invasion of cold on the skin is slowly giving way to a more rational view of the question. The profession has been slow to recognise this, but latterly it has been borne in upon us by the remarkable experiences of open air sanatoria. Dr. Prosser White has done good service in calling attention to the new view of things. He gives full consideration to the clinical characteristics of bacteriology, and to the prevention and treatment of a "cold." The little book is well worth reading and brings together in a handy form many scattered views of the subject. We only regret that the verification of his references and his proofs should have evidently been so hurried.

Not only do we find a foreign observer referred to as Hildebracdt, and Ziegler referred to as Zeigler (slips which one might overlook), but the name of one investigator of nasal bacteriology is given as Thomson St. Clair, Dr. Clive Riviere becomes Dr. Reviere, and a well-known physician to St. George's Hospital, appears as Dr. "Howslip Dicconson." It might be thought pedantic to refer to these points as being printer's errors, but our faith in Dr. Prosser White's references are somewhat shaken when we find, on page 49, that he attributes to "Sermoyez" (evidently a mistake for Lermoyez) a pronouncement on the nose, giving it in inverted commas, whereas the paragraph is a statement taken wholesale from the work of St. Clair Thomson and Hewlett.

Practice of Medicine: A Manual for Students and Practitioners. By HUGHES DAYTON, M.D., Principal to the Class in Medicine, New York Hospital. London: Hodder & Stoughton. 6s.

THIS is the volume on medicine in the Medical Epitome Series, and is one of the best members of the series. Limited in scope, diseases of the nervous system and of the nose and throat being excluded, it contains a vast amount of information. The classification of Osler has been closely followed throughout, and although free use has also been made of many other standard works, it may be looked upon as a condensed Osler, so far as general medicine is concerned. It will prove very useful to the student as a hasty reminder just before going up for examination.

Aneurysm of the Abdominal Aorta. Being a Dissertation for the Degree of Doctor in the University of Oxford. By FREDERICK PITCAIRN NUNNELEY, D.M., M.A. Oxon. London: Baillière, Tindall & Cox.

THIS thesis summarises the chief features and methods of treatment in one of the most serious, though relatively infrequent, forms of aneurysm. The author's conclusions are carefully worked out from the study of a series of 32 cases from the wards of St. George's Hospital. The injection of gelatin, devised by Lancereaux, appears to be without danger, but gave no better results than Tufnell's treatment.

Such measures as the introduction of wire have been disappointing, and the combination with electricity has only increased the risks of the operation.

The Diagnosis of Nervous Diseases. By PURVES STEWART, M.A., M.D., F.R.C.P., Physician to Out-Patients at the Westminster Hospital; Joint Lecturer on Medicine in the Medical School; Physician to the Royal National Orthopædic Hospital; Assistant Physician to the Italian Hospital. Pp. 362 and Index. 2 coloured plates and 192 illustrations in text. London: Edward Arnold.

IN this work, diagnostic methods are carefully described, and the significance of the various physical signs is shortly but clearly pointed out. The arrangement of the book is that of the lectures, in which the subject-matter was originally delivered; and this, though perhaps adding to the ease with which the volume can be read, is in our opinion a disadvantage when it is used for purposes of reference.

The index, probably from the arrangement in lecture form, is extremely full, and, so far as we have been able to test it, is very complete, but principal references are not distinguished from the most casual mention, so that, in some cases, it is necessary to refer to eight or ten pages before finding the particular point which is the object of search.

The chapter, dealing with pain, as a symptom, is especially good and is very full, and we may also mention that dealing with hysteria as among the most useful and interesting in the book.

The illustrations are, on the whole, extremely good, and do much to assist in the clear understanding of the letterpress.

The book should prove very useful to house physicians, and to practitioners, who have not had the opportunity of making themselves familiar with the diagnosis of nervous diseases.

Technique du Traitement des Tumeurs Blanches. Par le Docteur F. Calot
Crown 8vo. Pp. 263; illustrations 192. Paris: Masson et Cie.

Dr. Calot's name is well known to English readers in connection with his work on the spine. He is now engaged in publishing a practical treatise on Orthopædic Technique, and this is the third fasciculus. He deals with his subject under three headings: (1) Treatment in general, applicable to all kinds of pulpy swellings; (2) A clinical study of the cases in general, and the treatment of each stage; and (3) Special points dealing with pulpy swellings of the various joints. Speaking of the treatment of white swellings in general, Dr. Calot first discusses the way in which he deals with the *foyer tuberculeux.* He is very much in favour of intra-articular injections, and he specialises camphor-naphthol as useful. He then passes on to discuss conservative and palliative treatment. Afterwards, he deals with orthopædic measures, such as splints, extension, and supports, their uses and indications. In speaking of the clinical aspect of the subject, he mentions first of all white swellings with effusion, the fungous form, and the so-called rheumatismal form of tuberculosis, which is insisted upon by the French authors, but which receives little recognition in this country. Then he discusses, at considerable length, the presence and significance of sinuses, and concludes his work with a few words on the value of Bier's method of treatment.

The style of the writer is distinctly good, the subject matter clearly put, and the illustrations are excellent. Although we may not agree with the author in every particular, yet we think the volume is one which will well repay careful attention.

Report of the Proceedings of the National Conference on Infantile Mortality.
Pp. 314. London: P. S. King & Son. 1s. 6d.

This volume contains many interesting articles, chiefly by medical officers of health, dealing with the problem of infantile mortality. Dr. Niven considered the teaching of elementary hygiene in reference to the rearing of infants, as a necessary addition to the school curriculum, and illustrative schedules of the course of instruction are given. However excellent this may be in theory, it is difficult to imagine that much is to be gained by attempting to teach children the principles of infant feeding; and we are inclined to attach considerable importance to Miss Ravehill's statement that, in Belgium, such teaching has proved unprofitable. Professor Woodhead dealt with alcoholism in relation to infant mortality, and made out a strong case against alcoholic excess, whilst Dr. Ballantyne emphasised the part played by alcoholism, as an antenatal cause of infantile mortality. Among many articles dealing with various aspects of this difficult problem, it is strange that there is a total disregard of one of the largest factors, not only in the infantile mortality, but also in many of the social problems of to-day, the recklessly improvident marriages of the poor, and the ever-increasing encouragement of this improvidence by State-aided pauperisation; and if the "Municipal Milk Depôt," which is advocated in this volume, is to be another agency for the same purpose, as would appear to be the case, it is to be hoped that the rate-paying public will firmly oppose expenditure of public money for the support of any such depôts.

Notes by the Way:

Recent Congresses.

As a rule, proverbial philosophy is a helpful guide in determining the lines along which action on political, social, and moral questions should be taken, but sometimes such philosophical *dicta* are not a little mistifying. For instance, a wide and general application of "too many cooks spoil the broth" directly conflicts with that which teaches that "in a multitude of counsellors there is wisdom." The latter proverb, however, is aptly illustrated by four Congresses which have been held this summer. At these Congresses, the meetings of the Medical and British Associations, and the conferences on School Hygiene and the Better Housing of the Poor, subjects have been discussed in common, which have a direct bearing upon many urgent social problems of modern life, and it is not too much to say that the general result of the discussions is a distinct advance in the education and illumination of the public mind upon the questions thus dealt with.

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The Use and Abuse of Alcohol.

The discussion on the physiological and therapeutical use of alcohol, and the various references to the action of alcohol on nutrition, on the brain, and on the action of the heart, based upon experimental observations, would be somewhat perplexing, were it not remembered that laboratory experiments with pure, even if diluted, alcohol are not quite *ad rem.* These do not run on the same lines as the internal consumption of alcoholic beverages by man, in the varied conditions of his life. The action of pure alcohol is one thing, and that of the very much diluted form of it, in the ordinary so-called intoxicants of the table, quite another. As Professor Cushny said in his address, "the whole interest of the question at present lay in the dietetic use of alcohol as contrasted with the drunkard's abuse of it," and there is no doubt that the spirit, in which the question should be approached and discussed, is that to which

Dr. Hale White gave prominence in his admirable address at Exeter. That, under certain conditions of life, a weak form of alcohol, in the shape of light beers, wines, or well-diluted wholesome spirits, increases the taste for food is a fact of undoubted importance, and the use of such should not be condemned, as morally wrong, or on the ground that so much poison was being imbibed. At the same time, the abuse of intoxicating beverages cannot be too earnestly and severely condemned by all medical practitioners. The motto *par excellence*, which should be their guide, is *In medio tutissimus ibis.*

It has been urged that alcohol has a special value as a food, for it is easily absorbed, but that the objections to it are that it is an expensive type of food, and might lead to a continuous and undesirable habit. Its food-value, however, is comparable with that of sugar, which is in itself an alcohol, though of a more complex nature, and, as Professor Cushny says, "the more closely the metabolism under alcohol was examined, the more clearly was it seen to conform to that under an equivalent amount of carbohydrate." It is, therefore, "the continuous and undesirable habit" which must be avoided. There is no doubt that, among the better classes, in the present day, this is being done, but, as Sir Victor Horsley pointed out, "The Physical Deterioration Committee, appointed by the House of Commons, proved that the first greatest evil socially was defective housing, and that the second was alcohol." That the two are intimately connected is evident from the words of the committee. They "are convinced that the abuse of alcoholic stimulants is a most potent and deadly agent of physical deterioration. The mere statement of the contributory causes indicates some, at any rate, of the lines along which remedial effort may work effectually. Every step gained towards the solution of the housing problem is something won for sobriety. Direct proof was forthcoming of men, who had been addicted to alcohol, passing into better surroundings, with the result that they realised the fact, and found it a help to them in struggling against their weakness." Again we say, *In medio tutissimus ibis.*

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Medical Inspection of Schools.

A QUESTION that has recently received such an amount of attention from both writers and speakers as to bring it within the range of "practical politics," is that of the medical inspection of school children. This question naturally arises out of the Education Acts, which require the attendance at school of children from the age of five up to such an age as may be determined by local byelaws.

The International Congress of School Hygiene has formed a small council which, according to Sir Lauder Brunton and his colleagues, will in all probability consider *inter alia* "the question of how medical inspection of schools can best be carried out with the maximum of efficiency and minimum of cost."

The Committee on Physical Deterioration were emphatic in recommending that a systematised medical inspection of children at school should be imposed as a public duty on every school authority, and they further say: "With the assistance of teachers properly trained in the various branches of hygiene, the system could be so far based on their observations and records that no large and expensive medical staff would be necessary."

As an outcome of the recent discussions on the subject, *The Times* remarked: "The examiner would have to determine not only whether the child was of normal growth, weight, and chest development; not only whether his eyes and ears were free from any defect calculated to be an impediment to learning, and to render it injurious if forced; not only whether his teeth were such as to render proper mastication, and hence the proper assimilation of food, practicable; but also such points as whether the reaction of the brain to sense impressions was of normal character and promptitude, and such as to enable the examinee to hold his or her own in fair competition with average children." We may add to this that the examiner would also have to decide whether the child was physically capable of taking part in the ordinary physical exercises of the school, or whether there should not be a grading of such exercises adapted to the capabilities of the children; also whether the premises, and on this we would lay particular emphasis on secondary schools, are in every way suitable, from a sanitary point of view, for the proper training of boys and girls. Such an inspection can only be efficiently undertaken by properly trained medical experts, and these should be regarded as assistants to the Medical Officers of Health, and the tenure of their office should not be subject to the caprice of any local authority.

Just before going to press, it has been announced that the Board of Education have decided to establish a Medical Department to advise and assist them in the discharge of the new duties imposed on the Board by the recent Education (Administrative Provisions) Act in regard to the medical inspection of school children, which local education authorities are required by that Act to carry out in England and Wales. This action on the part of the Board must be regarded with satisfaction, as it foreshadows that the medical inspection of school children will be systematic and thorough, and independent of local influences.

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Anæsthesia.

It will be a happy day for the anæsthetist—the term nowadays is virtually synonymous with practitioner—when the ideal anæsthetic, now resting on the knees of the gods, is at length granted to us. We shall then be freed from the anxieties attaching to the use of a powerful narcotic poison, from the annoyances of the mucous spate engendered by a suffocative vapour, and from the coolie work involved in dragging about heavy iron cylinders. In the meantime, we should do well to take to heart much of Dr. Waller's recent address. The really astonishing fact is that there are not more regrettable incidents than those which happen from time to time. So far as the United Kingdom is concerned, chloroform is the agent most usually employed for operations, which continue to increase in frequency, in spite of (or is it because of ?) the "Simple life," Christian Science, and the host of well-advertised and much-vaunted infallible remedies. The open method of administration is most commonly adopted, partly on account of its extreme simplicity, and its independence of more or less elaborate and expensive apparatus, and partly because, backed by experience and authority, it is still taught, as the method *par excellence* for general use, at many of our medical schools. Some well-known anæsthetists are opposed to the use of apparatus, for teaching purposes, at any rate, on the ground that all such tend to lessen that sense of personal responsibility, on the part of the administrator, which is so essential to the safety of the patient. Modern research has clearly established that the risk is greatly minimised, if not abolished, by maintaining, at a low level, a steady percentage of vapour, and by avoiding intermittency. Even under the best conditions, this is impossible with the open method, especially in the high temperature now maintained in operating rooms. Means can surely be found whereby the safety of the low-level may be gained without loss of unremitting attention to duty. We know from the work done, since 1889, that, with all the valuable information which was gained by it, finality in the matter was by no means reached by the Haidarabad Commission, neither do Syme's instructions convey the last word on administration. Dr. Lawrie is up in arms because the findings of the former are ignored, and the value of the second called into question by Dr. Waller. He has no doubts whatever that sufficient has been done. Haidarabad is his Mecca, and Syme the only true prophet, and he unhesitatingly proclaims his faith *urbi et orbi*. If he is of opinion that the amount and the quality of the experimental work, which has been devoted to the subject, since 1889, by many able men, are not worth taking into consideration, his position will be one of splendid isolation.

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Nothing from Vivisection.

BATTERSEA, or a part of it, seems to be on the way to become the modern Cynopolis. The latter-day worshippers of Anubis have set up there a graven image with a startling inscription. Somewhere near by is an institution, boasting the grandiloquent title of "The National Anti-Vivisection Hospital." Those responsible for the name must surely be direct descendants of the famous tailors of Tooley Street. The chairman and vice-chairman of this institution are very much aggrieved, because the peculiar and particular merits of their temple have failed to obtain recognition in the shape of a grant from the Hospital Sunday Fund. They have consequently favoured Sir Edmund Currie with an exposition of their views, and, among other surprising things, assert that

> "our practical medical and surgical staff are satisfied that they are able to produce, without the teaching of vivisectional experiments, better results than your high medical authorities can accomplish under its influence."

This is a most remarkable assertion, for, if these words mean anything, and represent what is actually being done, we have here a body of men, educated in modern schools of medicine, declared by examining boards to be possessed of sufficient knowledge of modern medicine and surgery to be entrusted with the lives of their fellow creatures, but who have adopted lines of thought and methods of treatment distinctly archaic. At the bidding of their lay directors, the knowledge of the circulation of the blood, and, of course, all theories depending upon it, cannot be regarded as legitimately acquired. It seems impossible to realise their position, for the perplexity increases as the letter continues,

> "our surgical staff constantly perform the operations known to curative surgery with results that can challenge those of any hospital in the world."

How do they control the bleeding? Ligatures cannot be available, for the proper use of these was demonstrated by experiments, the meaning of which cannot be accepted. Perhaps Mr. Stanley Weyman has let them into the secret of those healing balsams which bring back his mighty fighters from the brink of the graves. What do the lay proprietors direct as regards Lister's discoveries?—but why pursue such enquiries? The scheme destroys itself by its inherent absurdity. How does this "practical staff" manage to reconcile the knowledge, which each member must still possess, notwithstanding the desired suppression of it by self-deception, or by subservience to the proprietor's views. If they depart one whit from the practice of præ-Harveian days, and employ any one of the means evolved since the great epoch in surgery, they are not only *participes criminis*, but cannot, in very decency, retain their appointments to this medically directed institution. Otherwise they occupy the immoral position, unhappily not unknown elsewhere, of those, who

> "Compound for sins they are inclined to,
> By damning those they have no mind to."

Practical Notes.

BACTERIAL ACTION IN THE INTESTINE.—By virtue of the free hydrochloric acid, which it normally contains, the gastric juice is antiseptic. On the other hand, an alkaline juice, like the pancreatic juice, is an eminently suitable medium for the rapid development of bacteria. It is, of course, very difficult to say exactly where the action of the pancreatic juice ends, and where the action of the bacteria begins, because many of the bacteria, which grow in the contents of the intestine, act in a similar way to the pancreatic juice. Some of the bacteria are capable of converting starch into sugar, others are able to convert protein into albumose, peptone, and amino-compounds, such as leucine and tyrosine. Other bacteria are capable of splitting up fat into glycerine, and a fatty acid. There are certain actions, however, which are entirely due to the presence of putrefactive organisms. Lactose, for instance, is converted into lactic acid, which in turn may be split into butyric acid, carbon dioxide, and hydrogen. Cellulose, in a similar way, is broken up into carbon dioxide, and marsh gas, or methene. This then is the chief cause of the gas in the intestine, and the amount is increased in proportion to the increase of vegetable food. The bacteria, besides splitting fat into glycerine and fatty acid, further split the fatty acid into lower acids, such as valerie and butyric acids. It will here be seen that the contents of the intestine must become acid, quite high up in the alimentary canal; but it has been shown that these organic acids do not in any way hinder the action of the alkaline pancreatic juice. The putrefactive organisms split proteins into fatty acids and amino-compounds, such as leucine and tyrosine; but they also have a further action in producing substances, which have a very bad odour, as, for example, *indol* (C_8H_7N), *skatol* (C_9H_9N), and *phenol* (C_6H_6O). If these putrefactive processes go on within normal limits, they are useful in aiding the action of the pancreatic juice, and preventing the entrance into the body of poisonous products. Lecithin, for instance, is a material contained in small quantities in many foods, and in much larger quantities in brain, and the yolk of eggs, it is broken up by the pancreatic juice into glycerine, fatty acid, phosphoric acid, and choline. Now choline is a poisonous alkaloid, but by the action of the bacteria, present in the intestine, it is broken up into carbonic acid, marsh gas, and ammonia. The fæces, amongst other things, contain some of the products of the decomposition of the food, such as fatty acids, indol, skatol, and phenol. On the other hand, some of these poisonous products are absorbed from the mucous membrane of the intestinal wall. Indol, for instance, is absorbed, and, during the process of absorption, is converted into indoxyl (C_8H_7NO), which interacts with potassium hydrogen sulphate to form indoxyl-sulphate of potassium, or indican, which is excreted in the urine. Brieger has shown that skatoxyl-sulphuric acid is formed from the skatol of the fæces, just as indoxyl-sulphuric acid is produced from indol. Skatol is oxidised to skatoxyl in the body, and appears in the urine as skatoxyl-sulphate. The red colour, which often develops in the urine, on the addition of acids, is in all probability to some extent due to some coloured derivatives of this substance. The formation of such ethereal sulphates is important, as has been pointed out, the aromatic substances, indol, skatol, phenol, liberated by the putrefactive processes in the intestine, are poisonous, but their conversion into ethereal sulphates renders them more or less inert.

INDICAN IN THE URINE.—This substance can be detected in the urine by its oxidation to indigo-blue. Perhaps the best method of detecting indican in the urine is that known as Obermeyer's, and is as follows:—Take 50 c.c. of urine, and add to it 10 c.c. of a 20 per cent. solution of lead acetate, then filter. The filtrate is then to be shaken with an equal volume of hydrochloric acid, which contains between ·2 and ·4 per cent. ferric chloride, and a few c.c. of chloroform. Indigo-blue is formed, and passes into solution in the chloroform. The presence of indican in the urine is very often a sign of intestinal putrefaction, and its quantity varies with the activity of that process. It must be understood, however, that indicanuria may also accompany the decomposition of albumin in other cavities of the body, a part which, of course, increases the clinical interest of the presence of the indican in the urine. Thus, V. Jaksch found large quantities in the urine of patients suffering from decomposing empyæma, gangrene of the lung, and putrid bronchitis. It is stated also that, when symptoms of peritonitis are present, the excretion of abundance of indican suggests suppurative processes in the peritoneal cavity. Moreover, the urine of healthy infants at the breast is free from indican, but when active protein decomposition sets in, as occurs in cholera infantum, indicanuria sets in too. "In general, therefore, the appearance in the urine of large quantities of indican implies that excessive albuminous putrefaction is progressing actively in some part of the system. However, we should be cautious in diagnosing any special morbid condition, such as a putrid abscess, from this symptom, seeing that a very conspicuous degree of indicanuria may result from simple constipation."

CHRONIC INTESTINAL AUTO-INTOXICATION.—In an article upon this interesting and important subject, which has recently appeared in the *American Journal of the Medical Sciences*, Professor Forchheimer says that, from a chemical point of view, chronic intestinal auto-intoxication is due principally, if not entirely, to the intestinal changes in the albumin and in the nuclein of the food, the changes in these two substances being the result of the activity of enzymes, or of bacteria in the intestine. As the result of these changes in protein food, indol, skatol, and phenol are produced, from the nuclein and nucleo-protein, the purin bodies, are produced, such as hypoxanthin, xanthin, adenin, and uric acid. These putrefactive changes occur chiefly in the lower portions of the ileum, cæcum, and colon, where large numbers of bacteria are present. If, for any reason, the colon is not emptied sufficiently often, a much greater chance, both for the formation and for the absorption of toxic bodies, occurs. From the intestine some of these toxic substances are absorbed, and pass for the most part, by the blood stream, to the liver, where they are subjected to oxidation, and, as a result, are rendered inert. They are then partly excreted by the lungs, but by far the greater part escapes by the kidneys and the skin. Herter has shown that the cells of the liver, the kidneys, the muscles, the blood, and the brain have a decided effect, in the order mentioned as to quantity, upon a change in phenol and indol, so that the toxicity is being reduced all the time.

The longer the contents of the intestine remain in the colon, the greater is the opportunity afforded for the bacteria to act upon these contents, and to bring about putrefactive changes, the slow peristalsis of the colon also favours the bacterial action.

Forchheimer has carefully analysed 77 cases, in which intestinal auto-intoxication was present. The symptoms complained of were various, some of those mentioned are the following:—Dyspepsia, recurring bilious attacks, chronic constipation, alternate constipation and diarrhœa, flatulence, recurring appendicitis, headache, migraine, neuralgia, vertigo, genito-urinary troubles, skin diseases, etc., etc. In many cases, Rigg's disease, or pyorrhœa alveolaris, was present. In all such cases, the large intestine should be thoroughly cleared out, and then carefully examined per abdomen. As a rule, quite healthy empty bowel cannot be felt, as was pointed out by Glérard and Sahli. If the bowel can be felt, as a rule, it means that the bowel is thickened, which may be due either to a spastic condition, or to a lesion, brought about by a chronic catarrhal condition with infiltration of the walls of the intestine In all cases the urine should be examined, when, as a rule, a large amount of indican is found to be present. Calcium oxalate is also present in a large percentage of cases, as well as uric acid, and an excess of urates. It is of the utmost importance, therefore, in treating patients suffering from chronic intestinal auto-intoxication to see that the contents of the bowels are sufficiently, frequently, and completely evacuated; at the same time, it is useful to combine with the drug used for clearing out the bowels a good hepatic stimulant or cholagogue. Mercury compounds, such as calomel, in doses of a half to five grains, are the best indirect cholagogues, whereas podophyllin, rhubarb, sodium sulphate, and sodium phosphate are good examples of direct cholagogues.

Dr. Burney Yeo says that, for relieving the milder forms of habitual constipation, there are few medicinal expedients better than the more or less regular use of a dinner pill, and the following is recommended :—

R.	Extracti Aloes Barbadensis	gr. iss.
	Pulv. Ipecacuanhæ	gr. ss.
	Extracti Nucis Vomicæ	gr. ss.
	Quininæ Sulphatis	gr. i.
	Saponis	gr. ss.

M. Ft. pil.

One pill to be taken immediately *before* dinner.

When the patient is taking the dinner pill, it is useful to order also a tumblerful of cold, or of an effervescing slightly alkaline water, to be taken night and morning. The patient, however, may find it more convenient to take the aperient, the first thing in the morning, in the shape of one of the natural purgative waters, such as Apenta Water, Hunyadi Janos, Friedrichshall, or Rubinat. Most of these waters contain magnesium sulphate. On the other hand, Carlsbad or Marienbad salts, which are composed chiefly of sodium sulphate, act more comfortably with many patients than do the bitter waters. The following medicine may be prescribed with advantage:—

R.	Magnesii Sulphatis	ʒi.
	Magnesii Carbonatis Levis.	gr. vi.
	Sodii Sulphatis	ʒi.
	Aq. Menth. Pip.	ad ℥i.

Misce. Ft. Mist.

Two or three tablespoonfuls to be taken the first thing in the morning before any food is partaken of.

Sodium phosphate may be substituted for the sodium sulphate. It is a milder, but sufficiently active purgative, less unpleasant to the palate, and is often given to children.

For the chronic constipation of women, especially where a painful condition of some of the pelvic viscera tends to constipation by the inhibition of intestinal peristalsis, the following formula may be tried :—

R.	Aloinæ	gr. iv.
	Strychninæ Sulphatis	gr. ¼.
	Extracti Belladonnæ Alcoholici	gr. iss.
	Pulv. Ipecacuanhæ.	gr. vi.

Misce.

The whole to be divided into twelve pills, one of which is to be taken daily.

Sir William Whitla recommends the following cascara mixture for habitual constipation :—

R.	Extracti Cascaræ Sagradæ Liquidi	℥ii.
	Tincturæ Nucis Vomicæ	ʒiii.
	Tincturæ Belladonnæ	ʒiii.
	Glycerini q.s.	ad ℥iv.

Misce Ft. Mistura.

A teaspoonful to be taken night and morning for four days, then only at night.

The Use of Potassium Iodide in Syphilis.—Fournier, some years ago, pointed out that mercury is the *only* drug to be relied upon as a preventive against the future phenomena of syphilis, and that potassium iodide, although no doubt a valuable accessory, is certainly *not* indispensable in the treatment of syphilis. The chief use of potassium iodide is in bringing about the absorption of syphilitic gummata, which occur in the later stages of the disease. It is true that some lesions certainly react better to a combination of mercury, and potassium iodide than to either of these drugs alone ; thus, in some of the later manifestations of secondary syphilis, syphilitic headache and periosteal pains, in cerebral and ocular syphilis, it is found that the combined treatment produces the best results, but it is occasionally found that some tertiary manifestations yield to mercury, although they have resisted the action of potassium iodide. In his book on syphilology and venereal disease, Dr. C. F. Marshall states that it is much better to combine the internal administration of iodide of potassium with either injection, or inunction of mercury, and he advises that "*a course of mercurial treatment should always follow the cure of a tertiary lesion by iodides,*" and it is possible, that, if this sound advice was carried out, there would be fewer cases of locomotor ataxia, general paralysis of the insane, and parasyphilitic epilepsy.

The following will be found to be useful ointments for mercurial inunction :—

℞. Hydrargyri - - - - ℥j.
Lanolini - - - - - ℥j.
Olei Olivi - - - - ℥ss.
Ft. Ung.

Dose for inunction ʒss. to ʒj.

℞. Calomel - - - - ʒj.
Lanolini - - - - ℥ss.
Paraffini Mollis - - - ℥ss.
Ft. Ung.

The latter is a very useful ointment for the local treatment of secondary syphilides.

For ulceration in tertiary syphilis, the following ointment may be used locally :—

℞. Iodi - - - - - gr. v.
Potassii Iodidi - - - - gr. xx.
Glycerini - - - - ʒij.
Lanolini - - - - ℥ss.
Paraffini Mollis - - - ℥ss.
Ft. Ung.

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THE PRACTITIONER.

NOVEMBER, 1907.

THE LOWER LIMIT OF AGE FOR SCHOOL ATTENDANCE.[1]

By ARTHUR NEWSHOLME, M.D., F.R.C.P.,
Medical Officer of Health for Brighton.

In May 1902, I read a paper on this subject at a meeting of the Childhood Society,[2] in which I urged that the attendance at school of children under five years of age should be prohibited, as it involved unnecessary and serious risk to health, was educationally worthless, and was contrary to the interests of public economy.

The increased local financial burden of education, caused by the passing of the Education Act of 1902, drew further attention to this subject, and led Education Committees to consider this among other possible ways of economising. A considerable number of such committees decided not to continue to provide accommodation for children under five, and this action was endorsed in the Education Code for 1905, the prefatory memorandum to which contained the following remarks by Mr. Morant :—

> Children under five years of age are not required by law to attend school, and there is reason for believing that the attendance of such children is often accompanied by danger to health. There is also a mass of evidence pointing to the conclusion that a child, who does not attend school before six years of age or more, will, in general, compare favourably, at a later age, with a child whose attendance began at an earlier age. On the other hand, there is no doubt that parents, in certain areas, desire that their children should attend school as soon after the age of three as possible, or even before that age. The extent to which parents, in any locality, desire that very young children should attend school, and the weight which should be attached to the wishes of the parents in this matter, are, no doubt, sufficiently well known to the Local Education Authority to enable them to deal, on their own responsibility, with the question of admitting or excluding children

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[1] A Paper contributed to the Proceedings of the Second International Congress on School Hygiene, August, 1907.

[2] "A Plea for the Exclusion of Children under Five Years of Age from Public Elementary Schools," *Public Health*, July, 1902.

under five years of age. In these circumstances, the Board will now give the Local Education Authority complete discretion on this point, and it will be held under Article 55 that a direction of the Local Education Authority to the effect that children under five shall be refused admission to any particular school or schools is a reasonable ground for excluding such children from the school or schools concerned. If the Local Education Authority so wish, different parts of their area may be treated differently in this respect.

Notwithstanding motives of economy, and this official expression of opinion, children under five, as shown in Table I. (Appendix), still form about 10 per cent. of all the children in the elementary schools of England and Wales. It is appropriate, therefore, that, at the meeting of this International Congress, the subject should receive discussion ; and I have accepted the invitation of the section to open the question. As England appears to be almost alone in having such a large proportion of its children in attendance at school prior to the age when compulsory attendance begins, and as, furthermore, compulsion, in the majority of countries, does not begin until the child attains the age of either six or seven years,[1] instead of at the age of five, as in England, we may hope for guidance from our foreign colleagues.

The experience of some of these foreign countries will be of value in regard to crèches, which are the alternative to school attendance under five in the minority of cases, in which exceptional circumstances render the mother unable to give the necessary domestic care to her child ; in Germany, and still more in France, such crèches are very numerous.

Table I. shows that approximately one-tenth of all the children in our elementary schools are under five years of age, while three-tenths are under seven years of age. Although it is doubtful if educational advantage, commensurate with the risk, is secured by the attendance at school of children between five and seven years of age, and, although I am strongly of opinion that the age of admission to school might be raised to six with advantage to education, health, and economy, I confine my remarks to the question whether it is justifiable in the interests of the children, of their parents, or of the ratepayers and taxpayers, that one-tenth of the teaching staff, one-tenth of the expenses of administration, and almost one-tenth of the total school accommodation should be used for children less than five years old.

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[1] "Statement as to the Age at which Compulsory Education begins in certain Foreign Countries" (*Parliamentary Return*, 1906, Cd. 2968).

ECONOMICAL ASPECT OF THE PROBLEM.

In 1904–5, the cost of elementary education in England and Wales was £18,398,618, or 72s. 10d. per scholar in average attendance. This amount does not include the cost of "special" schools. Of the cost per scholar, 46s. 11d. per scholar was spent on teachers' salaries, 11s. 7d. on maintenance, including rent, rates, repairs, 3s. 5d. on administration—officers other than teachers—and 8s. 7d. on loan charges. If we assume that each scholar in the infant school costs only 60s., then the children under five years of age attending school cost, in 1904–5, the total sum of £1,749,711. Of course if such children were excluded from school, a saving to this extent would not at once be secured, as the expense of buildings would remain. In small schools, especially in country districts, a considerable share of the accommodation thus saved could, however, be utilised for older boys and girls, and in this way expenditure on additional buildings be avoided.

EDUCATIONAL ADVANTAGES TO CHILDREN UNDER FIVE?

What educational advantage, if any, is secured to the children attending school at this early age, and is it worth the large sum now expended on it? In the former paper, to which I have referred, I argued this point in some detail. At that time, the instruction given to such children, as well as that to children between five and seven years of age, was much less sensible than that now given. It is now generally agreed, as officially stated on behalf of the Board of Education,[1] that:—

> Formal teaching, even by means of kindergarten occupations, is undesirable for children under five. At this stage it is sufficient to give the child opportunity to use his senses freely. To attempt formal teaching will almost inevitably mean, with some of the children, either restraint or over-stimulation, with consequent dangers to mental growth and to health.

This point is further emphasised by Mr. Cyril Jackson, Chief Inspector of the Public Elementary Schools, in an introductory memorandum to reports by women inspectors of the Board of Education on this subject (1905). He says:—

> It will be seen that there is complete unanimity that the children between the ages of three and five get practically no intellectual advantage

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[1] "Suggestions for the Consideration of Teachers .... in Public Elementary Schools" (1905, Cd. 2638, p. 22).

> from school instruction. . . . The children admitted later can, in six months or a year, reach the same standard of attainment as those who have been in the school for two years previously. It has always been claimed that the children admitted later are less easy to discipline. Even this seems doubtful, for these children very soon fall into the order of the school.

The educational uselessness of school attendance under five years of age may therefore be regarded as officially endorsed. Dr. Kerr,[1] however, dissents from this view. He objects to the past want of intelligence of the curriculum for children aged three to five, and urges this as a reason "for improving the kind of education and instructing the teachers," as children "learn more in the years from three to five than they will learn in the same period at any time subsequently." In another part of the same report, Dr. Kerr lays stress on the fact that "during the time it is in the infant department the child has chiefly to grow. Nutrition and sleep are its chief functions." Education is, of course, extremely active during this period, but, as Dr. Kerr shows, it is teaching in cleanliness and discipline, in marching, walking, and running, that is desirable. "Pens, pencils, paper, pins, and needles should not be handled in school by children below six," though real freearm drawing is valuable. The school is not, in my opinion, the best place for such training as is desirable at these ages. It is most naturally and most effectively acquired at home, and in healthy play with other children; or in crèches in charge of a nurse rather than a teacher, in the exceptional instances, in which the mother cannot give the requisite attention.

THE EVILS OF SCHOOL ATTENDANCE UNDER FIVE.

First are the

Educational Evils,

which have been already sufficiently indicated in the remarks previously quoted. Even with the regulations of the new Code, it cannot be said that these evils have been entirely prevented. Thus, following on the excellent sentiment quoted above from the "Suggestions to Teachers," the following remark appears:—

> Formal lessons may be given to children under five years of age, but any attempt which may be made to reach a definite standard of knowledge of

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[1] Report of the Medical Officer (Education) to the London County Council for the year ended March 31, 1905, p. 13.

reading, writing, and numbers, at the age of seven, should be subordinated to the more general aims of physical and mental development, and training in habits of obedience and attention.

It may be hoped that, in later Codes, the teaching of reading from books, or writing on slates or paper, will be specifically prohibited for children under five, or, better still, under six years of age. At such ages, injury to the undeveloped eye almost necessarily results from attempting to do near and fine work. When this prohibition has come into operation, one of the great

Dangers to Health

associated with early school attendance will have gone. There remain, however, two dangers, which cannot be escaped under present conditions of school work. These are (1) the general effects of breathing polluted air, and in particular (2) the occurrence of communicable diseases.

The evils of aggregation are not sufficiently acknowledged. To collect from 40 to 70 young children in one class-room, and from 150 to 600 in an entire infant school implies risk of serious magnitude. Schools necessarily involve aggregation; and scholars depend on it for a large part of their social education. Aggregation causes, however, physical mischief to the child. This risk is greater, and the social education, which is the sole benefit directly dependent on aggregation, is less with young children than it is with their elders; and a child under five—personally, I should say, a child under six or even seven—will not acquire appreciable good by way of social education to counterbalance the relatively high risk, which it runs from aggregation at that tender age; and what little good it may acquire would come to it inevitably, in the course of its later curriculum, if it survived to the ages in which aggregation is socially useful. The problem of the Public Health Authority, and of its Education Committee, is to reduce the evils of aggregation to the lowest attainable minimum; and I submit that this is not done when it is applied to children under five.

The first difficulty is the too small amount of floor-space occupied by each scholar. Although a larger floor-space would not compensate for deficient through-ventilation in each class-room, it would greatly facilitate such ventilation.

The second difficulty is the large size of the classes. At the beginning of the school year, the number in a single class may be only 40, but towards its end it commonly becomes 70, or even 80, and the small floor-space allowed by the rules of the Board of Education is much reduced. Such large classes are not only disadvantageous educationally, preventing thorough teaching and a reasonable amount of individual attention to scholars; but they also involve excessively large class-rooms, and—given in the two cases an equal amount of floor-space for each scholar—ventilation is more difficult and less efficient in large than in small class-rooms. Although the usual impression is to the contrary effect, the correctness of this statement is well established. Thus Dr. J. S. Haldane, F.R.S., and Mr. E. H. Osborn[1] say:—

> It is evident that, the form and general construction being the same, the larger a room the more slowly will the air in it be changed by penetration of air through the walls, etc., for the extent of walls, roof, and floor surface does not increase in the same proportion as the cubic capacity. The surface increases as the square, and the capacity as the cube, of any corresponding diameter for rooms of the same shape. Thus, an increase of eight times in the capacity will correspond to increase of only four times in the surface. Very large rooms, when unprovided with openings for ventilation, may thus contain very foul air, although the air space per person is very large.

Most schools have only natural ventilation, and are dependent for ventilation on windows, doors, etc. Under such conditions, size of room does not compensate for deficient exchange of air; and, *with a given allowance of floor-space to each child*, the small room has a definite advantage over the large room.

Increase of floor-space for each child, and diminution of size of classes, evidently involve serious economical considerations, but the additional expense ought to be faced; and probably it would be almost met by economising on the unnecessary and educationally useless accommodation now devoted to children under five.

> In my former paper on this subject, I remarked that with ordinary ventilation, which is all that is provided in the majority of schools, the atmosphere of an average school-room is as much fouler than that of the average house of the poor, as is that of a church during a Sunday evening service than that of a middle-class house . . . It will be observed that I am not speaking of the bedrooms of the poor; they will be occupied under the same conditions,

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[1] First Report of the Departmental Committee on the Ventilation of Factories and Workshops, p. 110 (1902, Cd. 1302).

whether children under five attend school or not. So far as their life during the day is concerned, the *vast majority* of children attending elementary schools are under more favourable conditions at home than at school.

On this point, I am able to quote the high authority of Dr. Haldane :—

> I am quite sure it is, as you say, impossible to get decent ventilation except by fans in elementary schools with the present cubic space allowance. The carbonic acid gas is far higher than in the worst dwelling rooms we found in Dundee, and the statement you quote from yourself (the first sentence above) is certainly correct.

The observations, made by Drs. Carnelley and Haldane at Dundee, show that the air in naturally ventilated schoolrooms was worse than that not only of the dwelling rooms, but also of the bedrooms of the poor. Thus :—

> Rooms in one-roomed houses (the worst and most crowded) gave in the middle of the night an average *excess* of 6·6 volumes per 10,000 of CO_2 and 60 micro-organisms per litre of air, with an average of 212 c. feet per person ; while the naturally ventilated board schools gave an average *excess* of 15·1 volumes of CO_2 and 152 micro-organisms, with an average of 168 c. feet per person.

To the difficulties of ventilation, when large numbers are closely congregated, must be added the nuisance arising from the aggregation of such a large amount of clothing, much of which is impregnated with organic matter, and is too seldom washed or renewed. It must be agreed, therefore, that, both in respect of uncleanliness and of deficient ventilation, the condition of the average scholar, and especially that of the youngest children, is worse at school than at home. That

Infectious Diseases

are spread to a large extent by the aggregation of children in schools, is verified almost daily in public health administration ; and such aggregation being essentially an evil, we have to strike a balance between educational advantages and the risks to health. At ages under five, these risks are greater than at higher ages, and there being no counterbalancing advantages, a serious waste of health and life is implied. Tables II. and III. in the Appendix bring out the extent of the excessive risk, at these ages, involved in attacks of the four most serious infectious diseases of school-ages. After six years of age, the attack-rate of both measles and whooping-cough rapidly declines, and the fatality, among those attacked, is relatively small after the fourth year of life. In diphtheria and scarlet fever, the attack-rate does not decline so rapidly; but the fatality, among those attacked, becomes relatively small after the age of five. Obviously, therefore, there is great advantage to children in postponing the age at which attack, if any, of these diseases occurs; for not only is a later attack less likely to be fatal, but, as Whitelegge has shown for scarlet fever—and probably the same rule applies for other infectious diseases—postponement of an attack diminishes the likelihood of subsequent attack.

Can attack of these infectious diseases be postponed, and, in the aggregate, can the number of attacks among a given number of children be diminished materially by postponement of school attendance? The point cannot be directly settled by statistics. The nearest approach to such statistical evidence is furnished by some local statistics as to measles, which I have collected, though these are necessarily scanty.

They relate to 596 cases of measles. Of these, 73 cases occurred in houses in which only one child lived; 70 attended school, 3 did not: 128 cases occurred in houses in which the only other children were 277 protected by previous attack; of the 128 attacked, 118 attended school, 10 did not: 395 primary cases occurred in houses, in which there were 975 other children; of this number 517 were protected by previous attacks, 631 were not thus protected; 344 secondary cases occurred, 287 escaping, although presumably susceptible. Of the 395 cases, 380 attended school, 15 did not. The relationship to school life is better shown by splitting up the cases into age groups.

AGE DISTRIBUTION OF PRIMARY CASES OF MEASLES.

Age.	Attended School.	Did not attend School.
0—1 - - - -	—	4
1—2 - - - - - -	—	8
2—3 - - - -	4	10
3—4 - - - - - -	63	2
4—5 - - - -	120	1
5—7 - - - - - -	295	1
7 and upwards - - -	97	—

One-third of the total children, aged 3-5 in Brighton, attend elementary school; among these nine-tenths of the primary cases of measles occurred. Even if a large allowance is made for more complete notification of cases among scholars, it is, I think, certain that school attendance greatly increases the risk at these ages.

Dr. Kerr[1] lays stress on the fact that 25 per cent. of the children entering school, at three years of age, had already had measles.

Some further light is thrown on this interesting point by the statistics in Table IV. (Appendix). For some years past, the history of each patient, admitted to the Brighton Isolation Hospital with scarlet fever or diphtheria, has been ascertained, as to whether they have already had attacks of other infectious diseases. The cases of children of school ages, for which this has been ascertained, are only 772, which, when split up according to age, leave somewhat scanty data for the different groups. Notwithstanding this fact, the percentages give some idea of the age-incidence of attack from the infectious diseases enumerated in the table. It has been found necessary to give under each heading, a group of doubtful cases, in which information could not be obtained. It will be seen that, of the children aged 3—4, from one-fifth to one-fourth had already had whooping-cough, and about one-third had already had measles, and that, of the children aged 4—5, over half had already had measles, and about half had already had whooping-cough. These two diseases are instanced, because they are the most fatal diseases of childhood, but the whole of Table IV. is instructive. The percentage of children, at the age of 3—4, who have already had measles, is higher than that given by Kerr. None of these percentages, however, settle the point at issue, nor do the figures in Tables II. and III. (Appendix), because no distinction is drawn, except in the scanty figures relating to my local experience (table in text), between the first and subsequent cases in each household. One has, therefore, to fall back upon experience in administration, which always shows that attendance at school increases the risk of importation of infection into homes; and upon the *a priori* high degree of probability that, if children were not admitted to school until after 5 years of age, the results would be that (*a*) fewer families would become infected, and (*b*) the children of those families still infected would be infected, on the average, at a higher age, with the result that fewer deaths would occur.

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[1] Annual Report of the Medical Officer (Education) London County Council, 1904, p. 13.

It being clear that great expense is being incurred by the attendance at school of children under 5; that no educational advantages result from such attendance, but that, on the whole, it is an educational evil, and is furthermore the cause of serious injury to health, and also of loss of life, what are the reasons which have led to such early attendance, and what are the administrative causes leading to its continuance? This introduces us to—

THE PARENT'S POINT OF VIEW.

It is urged that, if the children under five did not attend school, the older girls, especially those from twelve to fourteen years old, would be kept at home to tend them. This difficulty is a real one, though it cannot be contended that the best way out is to convert a large portion of our elementary schools into unwieldy crèches. There can be little doubt that if the rule, forbidding the admission to school of children under five, were universally and systematically enforced, and if some provision were made for exceptional children under five, it would be quite practicable to overcome this difficulty.

The exceptional children are, in particular, those whose mothers are obliged to go out to work. It is noteworthy that, in 1901, the proportion of the total married and widowed women in England and Wales, engaged in occupations other than domestic indoor service, was 11·8 per cent., the proportion varying at different ages, as shown below.

ENGLAND AND WALES, 1901.—PROPORTION OF MARRIED AND WIDOWED WOMEN ENGAGED IN OCCUPATIONS OTHER THAN DOMESTIC INDOOR SERVICE.

Ages.	15—	20—	25—	35—	45—	55—	65—	75 and upwards.
Per cent. (occupied).	11·9	10·9	10·0	13·1	16·0	17·5	14·4	7·2

It cannot be said what proportion of these had children under five, probably relatively few. It is lamentable that so many married and widowed women should need to engage in non-domestic work ; but, if we admit the necessity for their industrial employment, and the desirability of helping them by tending their children, at the outside only 10 per cent. of the children, aged three to five, need such tending owing to this cause. The total population at these ages, at the census of 1901, was 1,442,026, and about a third of this number were attending school, instead of the one-tenth, for whom extra-domestic occupation of the mother renders this desirable. To this number must be added cases in which, although the mother does not go out to work, home conditions are extremely unfavourable. These instances would be found by domiciliary visitation, and attendance at school, or the crèche, which I hope may replace it, made conditional as the result of such home visits. Evidently there is scope for saving, and at the same time aiding, the cases in which such help is needed.

The Provision of Crèches.

Such cases can be better aided by the provision of crèches, rather than of school accommodation. The matter is well put by Mr. Jackson in the report already quoted (pp. ii and iii) :—

> It would seem that a new form of school is necessary for poor children. The better parents should be discouraged from sending the children before five, while the poorer, who must do so, should send them to nursery schools rather than schools of instruction.
>
> "No formal instruction is the burden of all the recommendations, but more play, more sleep, more free conversation, story-telling, and observation." The aim of the big town infant school is too often to produce children, who, at the age of six and a half, have mastered the mechanical difficulties of Standard I. work. It should be to produce children well developed physically, full of interest and alertness mentally, and ready to grapple with difficulties intelligently.
>
> In this connection there is a general agreement that the best-informed teacher is not necessarily the best baby-minder.

So also in Miss Callis's report in the same volume the following statement is made (p. 104) :—

> What is wanted for children under five is more the kind of aptitude and training which would fit a girl to become a nurse. Brightness, sympathy,

and love of little children, as well as tact, are essential in managing children.

Such crèches should not be made to accommodate more than 25 children in two or three rooms, and there should be arrangements for feeding the children, as well as for general care. It would carry me too far afield to discuss the details of administration of crèches. There would often be no need for new buildings, as houses in the neighbourhoods, where they are needed, could be adapted for the purpose. By gradual extension of present crèches, by the combination of voluntary and official efforts, by the substitution of nurses for teachers, and by the careful selection of babies to be admitted to such crèches, a great improvement in the health of babies needing nursing and feeding could be secured, at a much less cost than that now involved in the maintenance of the inordinately large classes in our infant schools.

AN INTERIM REFORM.

The exclusion from school of children, under five, will probably be left, as at present, to the option of local authorities. On this point, Mr. Hackforth, M.A., clerk to the Brighton Education Committee, sends me the following suggestion :—

" It has occurred to me that there is a way in which your suggestion might be carried out without financial loss to the Committee, provided that the Board of Education would make a slight alteration in their method of calculating the grant for infants' schools. The average attendance, on which the grant is paid, as you are no doubt aware, is obtained by dividing the total number of attendances made during the year by the number of times the school has been open. Already on the annual returns, from which the grant is calculated, the attendances made by children under five and those over five have to be entered separately; they are then added together before being divided by the number of school meetings in order to obtain the average for the payment of grant. If the Board would allow the number of school meetings during the year to be entered separately, (1) for children over five, and (2) for children under five, and for each of these to be divided into the corresponding total number of attendances, in order to obtain a separate average attendance for children over and under five, you will see that there would be no loss of grant, if the younger children were excluded from some school meetings which the elder children were allowed to attend. This is a very small alteration in the method of calculating grant, and I think that we might reasonably expect the Board of Education to introduce it, if we could show that there were good reasons for doing so."

A representation from this Section to the Board of Education to the effect suggested in the preceding remarks would, I believe, be favourably received, and I hope that a resolution to this effect will be passed.

APPENDIX.

TABLE I.

ENGLAND AND WALES.[1]

For every 1,000 scholars on the school registers on the last day of each school year, the following was the number at the ages named :—

Year.	Under 5.	5—7.	All Ages over 7.	All Ages.
1895—6 - -	105	210	685	1,000
96—7 - - -	107	207	686	1,000
97—8 - -	112	214	674	1,000
98—9 - - -	115	214	671	1,000
1899—1900 - -	110	213	677	1,000
1900—01 - - -	107	214	679	1,000
01—02 - -	104	208	688	1,000
02—03 - - -	102	208	690	1,000
03—04 - -	101	206	693	1,000
04—05 - - -	96	209	695	1,000

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[1] Wilson, G. N.: *Public Health*, Vol. XVIII., p. 69; and Laing, J. S., and Prof. Hay: *Public Health*, 1902. Vol. XIV., p. 594.

TABLE II.

PREVALENCE AND FATALITY OF MEASLES AND WHOOPING COUGH IN ABERDEEN IN TWENTY YEARS.

Age.	Attack-Rate per 1,000 of Population at each Age.		Fatality, *i.e.*, No. of Deaths per 100 Persons attacked at each Age.	
	Measles.	Whooping Cough.	Measles.	Whooping Cough.
0 - - -	44	69	13·9	12·5
1 - - - -	86	74	10·0	10·1
2 - - -	86	73	3·4	3·3
3 - - - -	79	65	1·6	2·2
4 - - -	75	54	·9	1·6
5 - - - -	86	52	·7	·5
6 - - -	75	36	·5	·7
7 - - - -	47	19	·5	·1
8 - - -	21	9	·4	·3

TABLE III.

PREVALENCE AND FATALITY OF SCARLET-FEVER AND DIPHTHERIA IN LONDON, 1905.

Age.	Attack-Rate per 1,000 of Population at each Age.		Fatality, *i.e.*, No. of Deaths per 100 Persons attacked at each Age.	
	Scarlet Fever.	Diphtheria.	Scarlet Fever.	Diphtheria.
0 - - -	2·5	1·9	12·7	26·4
1 - - - -	7·1	5·0	13·6	21·4
2 - - -	13·1	6·7	9·1	13·2
3 - - - -	19·8	7·8	4·9	10·8
4 - - -	22·5	7·8	2·6	9·8
5—10 - - - -	16·8	3·9	1·6	6·3
10—15 - - -	1·9	1·4	0·8	2·4

TABLE IV.

TABLE SHOWING OUT OF 772 CHILDREN ADMITTED TO THE BRIGHTON BOROUGH FEVER HOSPITAL, THE PERCENTAGE AT DIFFERENT AGES WHO HAD OR WHO HAD NOT HAD THE FOUR MOST COMMON INFECTIOUS DISEASES.

Children at Different Ages.		Measles.			Whooping Cough.			Chicken Pox.			Mumps.		
Age.	Number.	Had.	Doubtful.	Not had.	Had.	Doubtful.	Not had.	Had.	Doubtful.	Not had.	Had.	Doubtful.	Not had.
0—3 - -	76	27·7	15·8	56·5	9·2	23·6	67·2	2·6	29·0	68·4	—	30·2	69·8
3—4 - -	83	31·3	18·1	50·6	22·8	19·3	57·9	14·5	21·7	63·8	2·4	25·4	72·2
4—5 - -	90	58·9	14·5	26·6	44·4	17·8	37·8	31·1	22·2	46·7	3·3	33·3	63·4
5—6 - -	100	57·0	16·0	27·0	39·0	19·0	42·0	27·0	18·0	55·0	7·0	29·0	64·0
6—7 - -	78	73·1	12·8	14·1	53·7	19·3	27·0	30·7	24·4	44·9	7·7	35·9	56·4
7—8 - -	67	76·1	10·4	13·1	55·2	17·9	26·9	44·7	20·9	34·4	7·4	35·9	56·7
8—10 - -	103	85·5	7·7	6·8	55·3	15·5	29·2	41·7	14·6	43·7	16·6	25·2	58·2
10—15 - -	175	74·9	13·6	11·5	62·4	17·0	20·6	38·7	27·5	33·8	23·5	28·0	48·5

ON THE NATURE OF THE EXPANSION PHASE OF THE CARDIAC CYCLE AND THE PHENOMENA ASSOCIATED WITH IT.

By T. STACEY WILSON, M.D., M.R.C.P.,
Physician to the Birmingham General Hospital.

THE object of this paper is to advocate the view that the ventricles of the heart are filled by their own muscular action, and not by the auricular contraction, and to show how this theory suffices to explain the various phenomena observable in valvular disease of the heart.

It is more than 20 years since dissatisfaction was openly expressed with the old theory as to the forces which fill the ventricles, and the belief has since been gaining ground that the muscular fibres of the heart are able, not only to develop force by their longitudinal contraction, but also, by an act of longitudinal muscular expansion,[1] to enlarge the cavity of the heart so as to develop force in the reverse direction.

In other words, the belief is surely gaining ground that the heart is a double acting pump, filling its chambers by its own back stroke, and that the ventricles are not dependent upon the auricles, or other outside agency, so far as the reception of the main part of their charge is concerned.

It is, after all, only natural to believe that such a perfect pump as the heart is, should not be inferior, in its mechanism, to the pumps which the wit of man devises.

It was 24 years ago that this theory was first brought under my notice by Dr. Lockhart Gibson, then of Edinburgh and now of Brisbane, who pointed out the support, which the experiments of the late Professor Rutherford gave to this view, by his demonstration that after receiving a minimal galvanic stimulus, a striped muscular fibre would, after contraction, *suddenly* return towards its former length, and that the force, developed by this sudden expansion, was approximately two-fifths of that developed during contraction.

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[1] Due probably to transverse contraction, according to Sir Lauder Brunton.

If these observations of Professor Rutherford had been generally accepted, the theory of the expansion of the heart muscle would have rested on a sure basis. There seems, however, to be some doubt as to the true interpretation of his experiments, and, therefore, in the absence of a physiological basis (apart from the fact that a transient negative phase is demonstrable in the intra-ventricular pressure curve) we have to depend upon clinical evidence. Clinical evidence is, however, not easy to obtain, owing to the nature of the problem.

Much can be done by the careful study of the heart's movements in health and disease by means of the cardiograph, but the time required to make careful observations, and then to measure and correlate the tracings, is very great, for very many tracings must be taken from all possible parts of the cardiac area, and from the large arteries and veins, before the interpretation of the cardiograms is possible with any degree of certainty.

As a result of very numerous observations during the last 16 years, I am certain that the cardiograph shows conclusively that the phase of ventricular contraction *is* followed by an active expansion movement.

CARDIOGRAPHIC EVIDENCE.[1]

1. As is well known, the cardiac muscle does not at once relax after the closure of the semi-lunar valves, and, if the time of occurrence of the second sound is carefully recorded on the cardiogram by an electric signal, this can be clearly demonstrated in tracings, taken at the apex or over the centre of the heart. Thus the cardiograph shows that the heart muscle remains *hard*, and therefore *active*, for an appreciable time after the end of the systole, and relaxation does not immediately follow the end of the systole as marked, by the closure of the semi-lunar valves.[1]

2. Further, the cardiograph shows quite clearly that, during this post-systolic activity, the heart muscle does not remain contracted, for the size of the ventricle is rapidly increasing. This can be demonstrated, if a series of tracings is taken from one side of the central axis of an enlarged heart, where many

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[1] *Brit. Med. Journal*, September 29, 1900, pp. 895–898.

different tracings are obtainable. Such tracings clearly show a fall, due to the diminution in the size of the ventricle as the blood is expelled from it, and following this fall is a sudden rise, pointing to the sudden return of the ventricle towards the size it was at the commencement of systole.

A record of the time of occurrence of the second sound, upon this type of cardiogram, shows that the maximum diastolic rise takes place immediately after the occurrence of the second sound of the heart.

I do not here refer to ordinary inverted tracings because these, when not due to faulty manipulation, are not very trustworthy, but to the cardiograms showing a systolic rise, and then a fall followed by another rise.

The fact that this diastolic increase in the size of the heart has power to lift the lever of the cardiograph against a pressure of some two or three ounces, or more, shows that it cannot be merely due to the elastic recoil of the *relaxed* muscle, neither can it be due, as has been suggested, to the inrush of the blood, which has accumulated in the auricle during the time of closure of the mitral valve. The mitral valve only remains closed for less than half of the cardiac cycle, the auricle cannot, therefore, be much more than half full when the mitral valve opens, and there can therefore be no inrush of blood under pressure from the auricle into the ventricle at this point of the cardiac cycle. Study of the cardiogram in dilatation of the ventricle hence appears to prove that true muscular expansion follows muscular contraction.

EXPANSION PHASE OF THE CARDIAC CYCLE.

This period of expansion of the muscular fibres appears to be a definite and well-defined phase of the cardiac cycle. Both cardiographically and clinically, its duration is well defined, and careful measurements of the portion of the cardiogram, representing this phase, as well as that of the cardiac sounds, which mark its duration, show its length to be about one-tenth of a second. Moreover, its length does not seem to vary, as do the other phases of the cardiac cycle, but, whether the heart is beating slowly or rapidly, it still has a duration of one-tenth of a second.[1]

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[1] Vide *Clin. Soc. Trans.*, Vol. XXXIV., p. 12.

We must therefore alter our conception of the cardiac cycle, and insert in it a phase of expansion thus :—

Ventricular contraction lasting $\frac{3}{10}$ of a second.
,, expansion ,, $\frac{1}{10}$,, ,,
,, relaxation ,, $\frac{4}{10}$,, ,,

THE FUNCTION OF THE AURICLES.

This being so, certain other points arise in connection with the function of the auricles.

If the size of the mitral orifice is noted in relation to the cubic content of the left auricle, it must, I think, be acknowledged that, under powerful suction developed by the ventricle, the contents of this chamber would be immediately drawn into the ventricle, although the aspiration lasted only one-tenth of a second, and that therefore the auricle would be empty by the time relaxation of the ventricle set in. According to the old theory, the auricle also empties itself during its systole. If this were so, the auricle would be twice emptied in each cycle.

Now during any particular cycle, as the flow of blood from the pulmonary arteries into the auricle is more or less regular, this double emptying of the auricle should result in its never having to hold the full charge of blood. In other words, if the heart throws three ounces of blood with each beat, we should expect to find that the cubic content of the normal auricle was somewhere about half of this amount.

But, as the normal capacity of the auricle is at least three ounces, there must be some error in this supposition. The error lies, I believe, in supposing that there is any considerable general emptying of the auricle during the auricular systole. It is probable, as was suggested by Mayo Collier,[1] in 1889, that the function of the auricle is only to throw a small quantity of blood into a nearly full ventricle, by means of the highly muscular appendix, for the purpose of closing and stretching the auriculo-ventricular valves prior to the commencement of systole; and that the body of the auricle has little, if any, power of emptying itself by its own contraction. The function, therefore, of the body of the auricle is to act as a reservoir, rather than as an accessory force pump for filling the ventricle, and the function of its muscular fibres is simply to make its walls tense enough for the action of the appendix to take place.

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[1] *The Physiology of the Vascular System*, p. 10.

This view of the function of the auricles fits in very well with the demands of the theory which we are discussing.

If the auricle does not empty itself to any extent at the time of the auricular systole, and is only emptied by the aspiration of the ventricle, it follows that that aspiration must draw into the ventricle the greater part of its full charge of blood, namely, nearly three ounces. [If this is so, it is possible that, in certain circumstances, the reception of this full charge may cause a preliminary closure of the tricuspid or mitral valve by its tendency to escape back into the auricle, and that the faint sound, which is sometimes heard at the commencement of the phase of relaxation, and which I call the third sound of the heart, may sometimes be caused by this quiet closure of these valves.]

We may, I think, assume that the body of the auricle acts simply as a reservoir, in which blood collects, and thus enables what is practically a full charge of three ounces to be drawn into the ventricle during its expansion phase.

CLINICAL EVIDENCE AS TO THE NATURE OF THE EXPANSION MOVEMENT.

It is not easy to obtain direct clinical evidence as to the nature of the expansion movement, but such evidence as is obtainable is all in favour of this theory, for by it all the phenomena of valvular disease can be explained very much more satisfactorily than by the older theory.

As to mitral regurgitation and stenosis.

According to the accepted theory, when compensation fails in mitral disease, extra work is thrown upon the right ventricle by the delay in the pulmonary circulation, and the re-establishment *and maintenance* of compensation depend upon the success, or otherwise, of the efforts of the right ventricle to overcome this.

When the power of the ventricular expansion is realised, this statement must be modified, so far as the *maintenance* of compensation is concerned, for this must depend upon the success of the left ventricle in compensating for its own defects. If the left ventricle fails, then, and then only, is extra work thrown upon the right ventricle, and its assistance called for.

MITRAL REGURGITATION.

Adequate compensation for mitral regurgitation must consist in both dilatation of the ventricular cavity, and hypertrophy of its walls (*see* Davies' *Circulation through Diseased Hearts*, 1887), *i.e.*, *dilatation* enough to enable the heart to hold the normal charge, plus the amount which will regurgitate into the auricle and *hypertrophy*, so that it may have strength to throw this extra amount.

Now, according to the theory under discussion, this change in the heart will not only suffice, so far as the systolic work of the ventricle is concerned, but will also give the extra power necessary to properly fill the ventricle during diastole. For this increase, both in its cubic content and strength, will increase its capability of aspirating blood from the auricle, and to the extent rendered necessary by the amount of the leakage. Therefore, at the end of the expansion movement in compensated mitral regurgitation, the auricle will be as fully emptied as normal, and the pulmonary circulation and the right side of the heart will not be hampered.

In proof of this, I have measured the loudness of the pulmonary second sound in cases of compensated mitral regurgitation, and I find that the true loudness of this sound does not exceed the normal limits, thus pointing to the probability that the right ventricle, in such cases, is not ordinarily called on to do more work than normal.[1]

There is usually some apparent accentuation of this sound in these cases, but this is due to the sound being simply sharper in tone, probably owing to the right ventricle increasing the force of its beat, in harmony with the action of the left, and it does not suggest any excess of pressure in the pulmonary artery, as will be explained more fully later on, under mitral stenosis.

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[1] *Clin. Soc. Trans.*, Vol. XXXV., p. 55.

MITRAL STENOSIS.

It is from mitral stenosis that the expansion theory receives the most clinical support, for it here sweeps away the difficulties which used to surround the explanations of the clinical phenomena associated with this condition.

PROCESS OF COMPENSATION.

In order to overcome the hindrance to the entrance of blood into the ventricle, greater aspiratory force is needed. This, according to the theory we are discussing, could be attained by the ventricle altering its beat.

In order to develop the maximal amount of suction during the short expansion period, the force of the ventricular contraction would have to be concentrated upon the very end of the systole so as to call forth the greatest possible amount of elastic and muscular recoil from the ventricular wall. But this change in the character of the beat *is* observable in mitral stenosis, for the first sound is abnormally loud, and also it ends very sharply, just as might be expected if it were trying to increase its suction power. I have heard the first sound of the heart 2 feet away from the patient, in a case of mitral stenosis, whereas normally it cannot be heard with a binaural stethoscope an eighth of an inch away from the chest wall. Further evidence on this point is given by the fact that, where the heart in mitral stenosis is temporarily embarrassed, the loudness of the first sound is often very noticeably increased for a time, and far in excess of the increase noticed in similar circumstances in health, or in other forms of heart failure. In such a case, the first sound returns to its usual loudness as the heart recovers itself.[1]

This change in the character of the first sound is, therefore, evidence in favour of the expansion theory, though it does not give special support to the theory of muscular, as apart from elastic, expansion.

Again, the fact that compensation depends upon the muscular action of the left ventricle accounts for the hypertrophy which is often noticeable in mitral stenosis, and which, according to the older theory, would not be so easily explained; also, in cases of death in mitral stenosis without rupture of compensation, it has been noticed that the left auricle is of normal size, and not dilated. This is what would be expected, if compensation were wholly due to the increased suction power of the ventricle, but would be very hard to account for by the older theory of compensation.

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[1] *Clin Soc. Trans.*, Vol. XXXV., p. 56.

PULMONARY SECOND SOUND IN MITRAL STENOSIS.

This theory of the freedom of the auricle from any embarrassment, in cases of well-compensated mitral stenosis, is further emphasised by the character of the pulmonary second sound, for, in the majority of these cases, which I have carefully measured, it does not exceed the normal limit of loudness, and in some cases is well within that limit. This statement may appear to conflict with what is a well-recognised sign of mitral stenosis, namely, accentuation of the pulmonary second sound, but it does not really do so. In most of these cases, the second sound, when heard by the stethoscope, *appears* to be much louder than normal, but, if some means are taken of deadening the sound, it will be found that its penetrative power is not increased, showing that there is no increase in the volume of the sound, as would be the case if it were due to increased tension in the pulmonary artery. This can be easily demonstrated by inserting a deflated rubber toy balloon under the stethoscope, and slowly lifting it by inflating the balloon through a tube with the mouth. So long as the stethoscope is within ½ or ¾ of an inch of the chest wall, the sound retains its loudness, but, when the stethoscope is raised higher, the sound is rapidly damped down, and is extinguished at 1 inch or 1⅛ inches, as is the case with a normal second sound. In uncompensated mitral stenosis, on the other hand, where the right ventricle *is* doing extra work, the sound may often be heard as far away as 1⅜ or 1½ inches or more.

In other conditions, where the right side of the heart is doing extra work, true increase in the loudness of the pulmonary second sound may also be observed. For instance, in some cases of anæmia, in which the tension in the pulmonary artery is certainly increased, the second sound may be heard when the stethoscope is raised as much as 2½ inches from the chest wall instead of the normal 1⅛ inches, and, in such a case, the sound may even be audible, without the interposition of the rubber bag, with the stethoscope $\frac{1}{8}$ or $\frac{1}{4}$ inch from the chest wall. Such a degree of accentuation as this I have never seen in fully compensated mitral stenosis or regurgitation, although it surely ought to occur if the maintenance of compensation really depended upon the work of the right heart. I have not infrequently noted an accentuation nearly as great as this occurring during the process of compensation, but which materially lessened as compensation became more perfect.

SPURIOUS ACCENTUATION OF THE SECOND SOUND.

The explanation of the apparent loudness of the pulmonary second sound, in these cases of compensated mitral disease, is to be found in the fact that the right ventricle cannot but partake in the forcible action of the left ventricle, and the increase of suction, which results therefrom, causes the blood in the pulmonary artery to return with greater rapidity against the pulmonary valves, but, as there is only the normal volume of blood in the artery, although the *sharpness* of the sound may be increased, its *volume* is not. It is the difference between the sound of a sharp blow with a small hammer and the more penetrating sound of a less sharp blow with a heavier hammer.

This absence of a true accentuation of the pulmonary second sound in mitral stenosis is therefore evidence that the increased ventricular aspiration is sufficient to effectively meet the altered conditions, and prevent extra work from being thrown upon the right ventricle when compensation is complete. The healthiness of the lungs, and the freedom from all signs of pulmonary congestion, which can often be seen in compensated mitral disease, is further evidence in support of this view.

MID-DIASTOLIC MITRAL MURMUR.

This theory of active ventricular expansion also suffices to explain the mid-diastolic murmur of mitral stenosis, much more effectively than the other theory.

The loudness of this murmur, and the presence, as can often be noted, of a well-marked thrill with it, points to its being due to some such force as that of ventricular aspiration, as was first pointed out by Dr. Lockhart Gibson, then of Edinburgh, in the *Lancet* for 1884; as was also the fact that this murmur often increases in loudness, as compensation becomes more effective.

The muscular nature of this expansion movement also affords an explanation of the reason why this murmur does not occur, as it might reasonably be expected to do, at the time of the closure of the semi-lunar valves, when the blood is, presumably, beginning to enter the ventricle.

This explanation will probably be found to be somewhat as follows:—

During the expansion phase, the cardiac muscles, as already stated, are still in a state of activity, albeit elongating instead of contracting, and the musculi papillares may reasonably be expected to partake in that activity. This being so, it is quite possible that, during the whole of this expansion phase of the cardiac cycle, the chordæ tendineæ are kept tense by them, and although the aspirated blood is flowing freely through the valve, its segments (being tense) are not free to vibrate in the blood stream.

When, however, relaxation comes on suddenly at the end of this phase, they *are* free to vibrate in the blood stream which continues to flow through the valve under the momentum imparted to it during the brief expansion phase.

According to this theory, the fixation of the valve segments, by the activity of the musculi papillares, prevents the first inrush of the blood from causing an early diastolic murmur in mitral stenosis, and delays its commencement till the onset of relaxation, which takes place, as before said, $\frac{1}{10}$th of a second after the closure of the semilunar valves. To this delay, the murmur owes its name of mid-diastolic (or as it used to be called post-diastolic) mitral murmur.

If the second sound and the commencement of the mid diastolic murmur are recorded by an electric signal upon a revolving drum, it will be found that the interval between them is about a tenth of a second; or, if the murmur is recorded on the cardiogram, it will be found to occur at the point where the heart muscle relaxes.

AUSTIN FLINT MURMUR.

Further confirmation of this theory as to the mode of production of the mid-diastolic murmur is furnished by a murmur which may not at all infrequently be heard in aortic regurgitation. I refer to the so-called presystolic, or Austin Flint murmur.

If this murmur is carefully timed, it will be found that it follows the second sound by the same interval as does the mitral mid-diastolic, namely, a tenth of a second, but, as in aortic regurgitation the heart is often rapid, and the diastole short, this interval of a tenth of a second brings it so near to the following first sound of the heart that it appears to be presystolic. Nevertheless, careful timing will show that its relationships are with the second sound and not with the first, for its relationship to the first sound alters, when the heart alters its rate, whereas its relationship to the second sound remains constant. It is, therefore, mid-diastolic and not presystolic.

In order to understand this murmur, it must be remembered that the anterior cusp of the mitral valve forms the posterior wall of the channel down which the regurgitant blood flows in aortic regurgitation.

During the expansion phase, while the valve segments are, according to supposition, held tense, they do not vibrate, but if the regurgitation is sufficiently prolonged and copious, it will cause vibration of the anterior segment of the mitral valve at the onset of relaxation. Careful mapping out of the area, over which this murmur is best heard, helps to confirm this theory, for it is often best heard over the body of the right ventricle, internal to the apex, over an area, where the vibrations of the anterior cusp of the mitral valve might well be conducted to the anterior wall of the chest, by the blood stream, which separates it from the muscular tissue of the septum, and of the right ventricle. The ordinary mid-diastolic murmur of mitral stenosis is not, as a rule, heard over this area so clearly as is the Austin Flint murmur, because the channel to the aorta is not, in this case, distended with blood, and there are not, therefore, the same facilities for conduction to the anterior wall of the chest.

In some cases, the mid-diastolic aortic regurgitant murmur has only the same area of audition as the mitral mid-diastolic, namely, at and internal to the heart's apex.

This explanation is further upheld by the observation that sometimes this Austin Flint murmur is quite faint, and is simply a mid-diastolic accentuation of the ordinary regurgitant murmur audible at the sternal end of the fourth or fifth left interspace, thus showing that it is not a separate murmur, produced elsewhere, but is due to the vibration of the same stream of blood, which is producing the aortic diastolic murmur.

THE THIRD SOUND OF THE HEART.[1]

In cases in which the flow of the blood is not strong enough to make the valve segments actually vibrate, the onset of relaxation is in mitral stenosis marked by a short sound, which is heard at the apex, and may be nearly as loud as the second sound itself, but follows it at the same interval (a tenth of a second) as the murmur would do.

This sound, which is usually called a "spurious," or "apical" reduplication of the second sound, is well known as occurring in those cases of stenosis which show a true presystolic murmur.

This third sound marks the commencement of the third, or relaxation, phase of the cardiac cycle, just as the second sound marks that of the second, or expansion, phase.

It may now be asked why this third sound does not occur in the normal heart if this theory is correct, and the answer is, that, in the normal heart, the rapid flow of blood through the mitral valve has ceased by the time relaxation sets in, and such blood as may then be passing through it is unable to move the valves suddenly enough to produce a sound. The reason for this becomes apparent, if the size of the mitral orifice is contrasted with the capacity of the auricle. In the normal heart, the opening is wide enough to allow the whole of the three-ounce charge to pass into the ventricle during the expansion phase, in spite of its only lasting so short a time, for the diameter of the full auricle would be about 2·15 inches, and the diameter of the mitral orifice is 1·18 inches.

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[1] Paper No. II., *Clin. Soc. Trans.*, Vol. XXXIV., pp. 10–23.

According to this supposition, anything which delays the emptying of the auricle, and so leads to the prolongation of the main flow of blood from it till the relaxation sets in, ought to produce this third sound, of which we are speaking, whether it is narrowing of the mitral orifice, as in mitral stenosis, or an excessive amount of blood in the auricle, or a defective aspiratory power on the part of the ventricle.

The correctness of this theory is indicated by the fact that we find this third sound clinically, in just such cases as we have indicated.

We not infrequently find a third sound present over the right ventricle in anæmia, due to either or to both of the last two causes we have just enumerated, for the ventricle is often acting weakly in such cases, and the auricle is over-distended with blood.

The third sound may also be produced in the manner referred to earlier, namely, by the mitral valve being closed, immediately after the expansion phase, by the endeavour of the aspirated blood to return from the ventricle back into the auricle.

This early closing of the mitral valve may be the cause of the third sound of the heart in some cases of mitral disease, and it is also quite possible that it may explain the occurrence of a third sound over the right ventricle in certain cases of anæmia with dilatation of the right auricle.

COMPENSATORY DILATATION OF THE LEFT VENTRICLE.

There is one other point, where this theory of active expansion solves what would otherwise be a problem not easy of solution, for it explains the compensatory dilatation of the ventricle in mitral regurgitation.

It is evident, where the mitral valve is incompetent, that at the end of systole, the auricle must contain, in addition to its normal charge of three ounces, the amount which has leaked back from the ventricle. This additional amount will, therefore, be aspirated into the ventricle, during its expansion phase, and will cause its dilatation. The ventricle is dilated by means of its own aspiratory force. Evidence of this is given by cardiographic records, in cases of mitral regurgitation, for a sharp pointed rise in the cardiogram is often observable after the commencement of the relaxation period, due to the impact of the aspirated blood upon the relaxed ventricular wall.[1]

It is not always very safe to arrive at conclusions by a process of exclusion, but, in the present instance, it is justifiable to conclude that a force, which can distinctly raise the lever of a cardiograph applied over the left ventricle, after the ventricular wall has relaxed (*i.e.*, after the ventricular and before the auricular systole) must be due to the impact against it of the blood which has been set in motion by the ventricular aspiration.

The mechanism responsible for this distension of the ventricle during its relaxation period, is best illustrated by a well marked case, such as that of a girl, who died in the General Hospital from mitral regurgitation, and with adherent pericardium. The adhesion having been prior to the onset of the regurgitation, the rigidity of the ventricular wall, thus brought about, prevented compensatory dilatation of the left ventricle from taking place. The result was that, at the post-mortem, the left ventricle was practically of normal size, holding only 90 cc., whereas the left auricle held 164 cc. In such a case as this, when the left ventricle expanded, it would, by its suction, set the 164 cc. in motion, and the momentum of the blood would tend to force more than the 90 cc. into the ventricle. The elasticity of the ventricle, strengthened as it was by the adherent pericardium, would expel the balance over and above the 90 cc. back into the auricle through the leaky mitral valve. This backward reflux, following the transient over-distension, would give rise to just such a sharp pointed wave as the cardiographic tracing showed.

The case, therefore, shows us that the momentum of the blood, aspirated into the ventricle during its expansion phase, is very considerable, and was able to over-distend the left ventricle when its walls were relaxed.

It also seems reasonable to assume that, had it not been for the pericardial adhesions, this distensile force would have been amply sufficient to cause dilatation of the ventricular cavity, until its size approximated to that of the auricle; in other words, to produce the necessary *compensatory dilatation* of the ventricle.

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[1] *Clin. Soc. Trans.*, Vol. XXXIV.. pp. 17 and 18.

In this case, although there was no mitral stenosis, a loud third sound was audible over the heart, as would be expected according to the theory of its causation, as already stated.

Where the right ventricle is constricted, in a similar way, by adherent pericardium, a similar reflux of blood from the undilatable ventricle gives rise to a distinct diastolic impulse in the veins of the neck, and the presence of this wave, which is clearly visible, is a sign of ill-omen for the patient.

These then are the points in favour of the theory of cardiac action which I am advocating, and they appear to me, when taken together, to give undoubted support to the view that true muscular expansion plays a most important part in the heart's action.

If this is so, it would be well to alter the nomenclature of some of the heart's sounds and murmurs as follows:—

The *first* sound marks the commencement of ventricular contraction or systole.

(Contraction or systolic murmurs may be produced at mitral, aortic, tricuspid valves, etc.)

The *second* sound marks the commencement of expansion.

(An expansion murmur occurs in aortic regurgitation.)

The *third* sound (when present) marks the onset of relaxation.

(1) A relaxation murmur may occur in mitral stenosis, etc.

(2) Occasionally, at the tricuspid orifice in dilatation of the right heart.

(3) As an addition to the expansion murmur in aortic regurgitation.

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MOVABLE KIDNEY.

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[With Plates XV., XVI.]

(*Continued.*)

PATHOLOGY.

Movable kidney is a disease which is of itself rarely fatal, and therefore a complete case, that is to say, one which has been under clinical observation, and which has been subsequently carefully examined post-mortem, is a rarity.

Although movable kidney is a fairly common clinical condition, yet such authorities as Ebstein and Neumann record it as appearing only 16 times in a series of 14,698 autopsies. The explanation of this discrepancy lies in the fact that, unless the mobility is actually sought for, and this is by no means part of an ordinary routine post-mortem examination, only the most pronounced cases, or those, in which some gross renal lesion exists, are recorded.

Even if noticed, the records are very frequently so brief that they are useless except from a statistical point of view.

Landau, after an exhaustive search, was able to secure the accounts of only 16 autopsies, recorded in sufficient detail to be of value.

The information, derived from surgical procedures, is also necessarily limited, because through the usual lumbar incision for nephropexy, only the kidney and its pedicle can be examined, and a very imperfect idea of their relations obtained.

The kidney does not often present at once in the wound, and has to be hunted for in the depths of the lumbar recesses, perhaps even in the iliac fossa of the affected side. When it is brought into view, therefore, its relations may be altered, and it is difficult to be certain of the relative positions of even the component parts of the pedicle. Such changes, for instance, as arterial curvatures are obliterated by the manipulations necessary to bring the kidney up into the incision, or out on to the loin.

The following statements, therefore, are based on the comparatively few post-mortem records which we have been able to secure, on personal observations during nephrorrhaphy, or on those few cases, in which the abdomen has been opened, either as the result of a mistaken diagnosis (*e.g.*, pyloric cancer), or in order to ascertain the condition of the opposite kidney.

We have also attempted to fill in the gaps of this somewhat scanty pathology by recording the results of the experimental work which we have performed on animals.

The kidney can become movable in one of three ways :—

I.—As a result of the rapid absorption of the capsula adiposa, the kidney may prolapse, and become slightly more movable than normal within its perinephric sheath.

II.—The degree of mobility may be increased, together with anterior and inward displacement of the gland, either (*a*) by bulging of the perinephric fascia ; or (*b*) by loosening or stretching of the perinephric attachments to the vertebral column.

III.—In the traumatic cases, by rupture of the true suspensory ligament of the kidney, with the result that the upper renal pole falls forwards.

As the kidney slips downwards within its sheath, the lower pole, guided by the direction of the perinephric funnel, gradually passes towards the middle line, so that the long axis of the organ comes to be directed from above downwards and inwards.

Pari passu with this change, the kidney undergoes slight rotation around its vertical axis, so that the hilum often looks almost directly forwards, and, at a post-mortem examination, whilst the organ is still *in situ*, appears to be on the anterior aspect of the inner border of the gland.

Soon, as a result of this, traction is made on the renal vessels, and the lower pole passes still further inwards, describing, in its course, an arc of a circle, the centre of which is at the point of origin of the renal artery from the aorta, the artery itself being the radius.

The unsupported weight of the kidney produces elongation of the renal vessels, and the organ becomes suspended by its own neurovascular pedicle. This traction on the renal plexus causes the referred aching pain in the lumbar region of which so many patients complain.

Whether by means of the coronary ligament, in the case of the liver, or by the true and the ovario-pelvic ligaments, in the case of the ovary, Nature always so arranges matters that normally strain of support is not thrown upon the vessels and nerves, the entirety of which is essential for the proper performance of the normal physiological functions of the gland.

If this mechanism gives way, its failure is made evident by feelings of pain and distress, expressed by the patient, or by signs of degeneration, occurring in the organ itself. These are brought about by mechanical interference with its circulation, or by disorganisation of its nervous mechanism.

The change of position, which the kidney undergoes, brings about lengthening and narrowing of the renal vessels, and an alteration in the direction, and occasionally of the calibre, of the upper part of the ureter. The part of the ureter, which lies within the perinephric capsule, is free, and follows the kidney in all its movements, but immediately it pierces the post-nephric fascia, and passes downwards and inwards on the psoas muscle towards the pelvis, it becomes much more firmly fixed in position. We see, therefore, in these cases, the ureter passing at first upwards and perhaps inwards from the renal sinus, and then making a more or less acute bend to resume its normal course on the posterior abdominal wall.

The points stated above are exceedingly well brought out in the record of a post-mortem examination, made by Mosler, in 1866, and we have been so much impressed by its extreme accuracy of description that we have thought fit to reproduce it in some detail.

The subject was a woman, æt. 36, who died of pneumonia.

Mosler says :—"The right kidney was deeply situated under an enlarged liver. The kidney was rotated half round, so as to bring its outer convex border almost entirely horizontal and looking downwards, and on a level with the crest of the ilium, the hilum looking upwards and inwards.

"The right renal vein ran obliquely upwards, and opened into the vena cava inferior at a somewhat acute angle. The ureter, which was entirely covered at the origin by the kidney, first describing a slight curve, ran upwards over the trunks of the great vessels, and then passed towards the pelvic cavity as usual.

"The diameters of the vein, artery, and ureter were normal. No special alterations, attributable to the abnormal position of the kidney, could be made out.

"The right kidney was slightly smaller than the left kidney."

The kidney usually slips downwards and outwards from underneath the duodenum, but, in some few instances, the peritoneum, covering the anterior renal surface, is more adherent than usual, and, by the dragging of the kidney, thickened peritoneal bands are formed which constrict the duodenum.

The best marked band is usually found narrowing the lumen of the duodenum near the termination of its second part ; but sometimes one or more may also be seen passing upwards to the neighbourhood of the pylorus, or the termination of the first part of the duodenum. As a result of this stenosis, the stomach and duodenum may become enormously dilated, as in the following case, which Bramwell brought before the annual meeting of the British Medical Association in 1901.

It will be seen that probably, in this instance, the irritation caused by the dragging on the pylorus had given rise to great hypertrophy, and occasional spasm of the pyloric sphincter. In this patient, the symptoms were so severe that they ultimately proved fatal, but, in the more common type, this interference with the gut is only shown as chronic dyspepsia, or in acute attacks of nausea and vomiting with severe epigastric pain, brought on by some sudden strain or unusual exertion.

Case.—Abstract of History.—The patient was a woman, æt. 49, who for 29 years had suffered from repeated attacks of severe "indigestion," which had become worse in the last 10–15 years; attacks consisting of a feeling of epigastric uneasiness, followed by feeling of great distension and pain, but relieved by vomiting.

These paroxysms were always brought on by exertion, not much relieved by a careful *régime*, diet, or drugs, but relieved by rest.

The right kidney was fairly movable, and it was noticed that the stomach was often much dilated at times, but, in spite of the use of a firm bandage and renal pad, the patient gradually got worse. The attacks became more frequent in their occurrence, and more severe in nature, and eventually proved fatal from syncope, brought on by acute excessive dilatation of the stomach by gas.

Post-mortem Examination in Full.—"On opening the abdomen, the whole of the left hypochondriac, epigastric, and umbilical regions were found to be occupied by an opalescent sac, reaching down to within 2 inches of the pubes. It looked exactly like a thin, flaccid ovarian cyst. This was found to be an enormously dilated stomach, hanging down like a large bag. The cardiac end filled the whole of the diaphragmatic vault, and was as thin as wet paper, tearing with the least traction, while being brought to the surface.

"The pylorus was distinctly lower than normal, and surrounded by thickened and matted peritoneum. It was distinctly thickened and contracted. The swellings, felt behind the pylorus during life, proved to be the head of the pancreas and lymphatic glands, surrounded by thickened fibrous tissue, but in which no malignant disease was present.

"The duodenum, which was much distended, formed a sausage-shaped sac, constricted at both ends. Its junction with the jejunum was constricted, and firmly held down by a band of thickened peritoneal tissue, which extended downwards towards the right iliac region, and then gradually spread out into the mesentery. It appeared to be the right border of the large mesentery.

"Extending from the surface of the pylorus downwards, and to the right, were three distinct cords of thickened peritoneal tissue, which gradually spread out over the right kidney. The latter was freely movable up and down for the space of 3 inches, and with it moved its peritoneal coverings. When the kidney was pulled down to its full extent, the three peritoneal bands were very distinct, and clearly dragged upon the pylorus.

"Before anything was removed from the abdomen, it was distinctly seen how the descent of the kidney tightened and dragged upon the peritoneal covering of the pylorus. Also the natural covering of the kidney moved with it, and its lower margin did not glide under the peritoneum, but moved over the peritoneum on the surface of the posterior abdominal wall, caused by an overlapping of the two peritoneal surfaces.

"On opening the stomach, the contraction of the pylorus was found to be of a purely muscular nature from hypertrophy of the sphincter, the mucous membrane covering it being healthy.

"Microscopic examination of portions of the sphincter, and also the thickenings round the pylorus, proved the absence of malignant disease."

The common bile duct may also be affected with the production of the slight degrees of transient jaundice, which sometimes occurs in cases of movable kidney.

This symptom is probably caused by temporary dragging on the duodenum, in the neighbourhood of the ampulla or Vater, by the bands described above, and is certainly never due to actual mechanical compression of the common bile duct by the kidney itself.

In some cases of movable kidney, occurring in patients showing general enteroptosis, in which the duodenum and liver have clearly suffered, the fundus of the gall bladder may be found even on a level with the iliac crest. The S-shaped curve of the cystic duct is obliterated, and the duct is bent acutely on itself, so as to form an angle not greater perhaps than one-third of a right angle. This of itself might produce a mucocele of the gall bladder, and the accompanying narrowing and stretching of the common bile duct might be so pronounced as to produce biliary stasis, followed by an infection of the biliary passages, and the formation of gall stones.

Certainly, cholelithiasis and cholecystitis are not infrequently seen in cases of movable kidney, and may give rise to some difficulty in diagnosis; but we are inclined to think that these conditions occur rather in association with, than as the result of, movable kidney. Moreover, it must be borne in mind that these middle-aged women, living a sedentary life, and often compelled by dull, dragging lumbar pain to rest upon a couch for days at a time, are just the subjects in whom cholelithiasis is most common, and it would therefore be indeed surprising if gall stones were not occasionally found in such cases.

But that movable kidney can do more than produce a slight icteric tinge, coming on after an acute attack of pain in the loin, we are not prepared to admit.

Dr. Ochsner has described a sphincter of the duodenum, just below the entrance of the bile and pancreatic ducts, and it is possible that spasm of this, produced in the same way as that of the pyloric sphincter in Bramwell's case, might cause a temporary jaundice of slight degree. That a freely movable kidney can produce marked pressure effects on the surrounding organs is well shown in a case recorded by Girard.

Case.—A middle-aged woman, who, six months previously, had had severe abdominal pain brought on by an attack of coughing, and for one month had noticed swelling of the right leg, died of pulmonary tuberculosis.

At the autopsy, the right kidney was found to possess a mesentery at least 2 inches in length. The kidney was lying to the inner side of the ascending colon, the latter, distended with gas, pressed the kidney against the inferior vena cava, At this spot, the vein showed considerable constriction with dilatation below to double its normal calibre. From the heart downwards to the site of stricture, the vein was healthy, below this point it was thrombosed to within 2 inches to 3 inches of the groin. There was considerable œdema of the right leg.

The stomach and the duodenum are, however, not the only parts of the alimentary tract which show pathological changes.

In discussing the ætiology of movable kidney, we suggested that one of the causes of the greater frequency of the condition on the right side was the drag of a habitually distended cæcum, acting through the ascending colon. At first sight, it is a little difficult to understand how this is brought about, and in normal conditions it probably does not occur.

But Arbuthnot Lane has shown how common it is to find dense adhesions of peritoneal thickening encasing the ascending colon, and that this obstruction is most marked in the upper 2 inches of its extent. He attributes this condition to an old peritonitis, either of tuberculous origin, or one originating in the appendix. He also thinks that a common cause is the habitual distension of the cæcum as the result of constipation, and associated with attacks of inflammation in the wall of the gut. In this way, the hepatic fluxure may become firmly adherent to the anterior surface of the right kidney, and the downward pull be made possible. The following case well illustrates this point:—

Case.—C. S., a married woman, æt. 23 years, came under treatment in June, 1900.

She stated that, two months previously, she had brought on an acute attack of pain in the right loin, accompanied by increased frequency, and urgency of micturition, by jumping from a high table. Since that time, she had suffered from occasional shooting pains, radiating from the right lumbar region downwards along the outer aspect of the right thigh. She was said to have had a bad attack of "inflammation of the lungs" as a child, and showed evidence of old Morbus Coxæ.

At the operation of right nephropexy, the kidney was found freely movable in all directions, but firmly adherent to the ascending colon, which moved with it, and from which considerable dissection was necessary to free it.

This must, however, be an explanation which holds for only comparatively few of the cases, and we have yet to explain the frequent coincidence of abnormal mobility of the kidneys with downward and inward displacement of the ascending, or more rarely of the descending, colon.

As the kidney slips about on the posterior abdominal wall, in what Morris has described as the cinder-sifting movement, it gradually loosens the attachments of the peritoneum, and the latter becomes relaxed and flaccid as the result of the drag of the bulging kidney. The kidneys slip downwards and inwards, and then usually come forwards on the inner side of the colon, but, in a few cases, the right kidney may appear to the outer side of the ascending colon. Should the perinephric fascia become sufficiently stretched, the kidney will fall still further forward towards the anterior abdominal parietes, carrying before it the loosened peritoneum. If the latter is sufficiently relaxed, and considerable absorption of capsula adiposa has taken place, in some rare instances, the kidney may form an almost complete investment for itself, and possess a mesentery of 2 inches, or even more, in length.

With the rarest of exceptions, floating kidneys have derived their mesenteries in this way, and we are afraid the congenital mesonephron must be regarded as a myth of the embryologist's imagination.

If such a condition did exist, it is almost inconceivable that, in the easily palpable abdomens of children, such "tumours" should be of so comparatively rare occurrence.

The kidney also, in the early stages, may insinuate itself between the layers of the ascending or descending mesocolon, and, by its subsequent movements, still further loosen the colic attachments, and facilitate the downward glidings of the gut. So pronounced may this become that the cæcum, which itself may be on a lower level than usual, appears to pass at once into the transverse colon, which may lie within the cavity of the true pelvis.

An abnormally mobile kidney may become secondarily fixed by adhesions to the surrounding viscera, of which the commonest are:—

(*a*) The lower border of the liver,
(*b*) The gall bladder,
(*c*) The transverse colon.

An interesting point is that, in many of the cases recorded, in which the kidney was adherent to the inferior sharp margin of the liver, it was fixed by its outer convex border in such a position that the hilum looked almost directly downwards.

CHANGES IN THE KIDNEY.

In discussing and interpreting the pathological changes which are found in abnormally mobile kidneys, two points must be always before our eyes, and we must ask ourselves this important question.

Are the changes, which we find, the causes of, or merely the results of, movable kidney?

Large and heavy tumours of the kidney undoubtedly do sometimes become movable, and in this category, we would place some cases of hydronephrosis, polycystic disease of the kidneys, and some large solid renal tumours, especially swellings which have had their origin in suprarenal rests. These we do not propose to consider here, but it is interesting to note that Rayer and Brunet record tumours of the suprarenals and pancreas as displacing and mobilising the kidneys.

Case.—A. S., a tailor, æt. 35, was admitted into St. Bartholomew's Hospital, in May 1900, with the following history:—

About six years previously, patient had noticed a swelling in the region of the umbilicus, and, since that time, had suffered a good deal from dyspepsia and obstinate constipation.

He had experienced several acute attacks of pain in the abdomen within the period mentioned above, and these were occasionally followed by hæmaturia.

On exploring the abdomen, the left kidney was found to be represented by a knob of tissue 1 inch by ½ inch. The right kidney was lying to the right of the umbilicus, immediately beneath the anterior abdominal wall.

It was of large size, about 5 inches by 3 inches, horseshoe shaped, and freely movable. Its upper pole was considerably enlarged, and showed a lobulated cystic condition, which was, at the time, thought to be of congenital origin. It is probable that here the mobility was a secondary condition, the symptoms dating from its time of onset.

A somewhat similar case is recorded by J. Hutchinson, jun., in *Clin. Journal*, October 25, 1905.

It is not uncommon to find congenitally large kidneys, whether those of normal or horseshoe shape, very freely movable, and, after looking through the records of a large number of cases, our impression is that a large kidney of this description is much more liable to become movable, and to cause symptoms, than an organ of normal size.

In doing a nephrorrhaphy on the ordinary subject, the spare long-waisted woman with shallow loins, two points are at once evident.

(*a*) The extremely small amount of capsula adiposa, and also of the fat, which ordinarily lines the lumbar recesses.

(*b*) The actual mobility of the kidney is often far in excess of what was suspected from the clinical examination. The kidney, with its lengthened vessels, often almost shoots out of the wound, when pressure is made on the front of the relaxed abdomen.

In the chronic cases, the kidney usually appears somewhat small and light, is rather pale in colour, and has a peculiar flabby feel quite apart from any dilatation of the pelvis. Usually the capsule does not appear thickened, strips readily, and does not leave a granular renal surface. It is said that the opposite kidney hypertrophies to make good its fellow's deficiency, and Rayer records an extreme case, in which the affected kidney weighed 80 gms., whilst the sound one scaled as much as 150 gms.

One cannot help thinking, however, that, in some of these cases, the smallness of the organ, and its concomitant mobility, are effects of one common cause, viz., mal-development of the kidney, and its perinephric supports.

In one or two cases, we have observed fibrous thickening, producing scarring and puckering of the kidney surface, but these cases must be looked upon as exceptional. Sometimes the capsule is so friable that it tears in the dissecting forceps in the attempt to reflect it.

Speaking of the pathological changes which may occur in a movable kidney, Landau says :—

"In some cases, the kidney substance is itself degenerated, sometimes by fatty changes, sometimes by the contraction of the connective tissue within it, and it is sometimes in a state of hydronephrosis."

Hurry Fenwick makes the statement that :—

"Some form of ureteric obstruction, either an acute bend of the ureter, due to adhesion or mal-insertion in movable kidney, or a valve, or a vessel-leash, bow-stringing the ureter, may produce a local interstitial nephritis."

He also says :—"There is generally infection in addition to the obstruction."

On several occasions, we have cut sections of minute wedge-shaped portions of the renal cortex, removed at the operation of nephrorrhaphy, but were able to find no definite evidence of any interstitial change.

In one patient, a woman, æt. 25, sections showed perhaps a slight increase in young fibrous tissue, but the alteration was so minute that we hesitate to lay any stress upon it.

In another patient, a woman æt. 21, there was a minute cortical cyst present.

The acute cases show a very different picture, even when operated upon some time after the attack has passed off. The kidney is large, engorged with blood, and dull red, or even purplish in colour.

The pelvis is usually dilated, but as this enlargement takes place chiefly within the renal sinus, the extra-renal portion not being a prominent feature in the pedicle, the former condition may pass unnoticed, unless careful observation is exercised.

The renal poles overhang the hilum, and the whole kidney appears more curved than usual, indeed, when felt by the hand inserted through the lumbar wound, it may give the impression of being a horseshoe-shaped organ. On the surface of the kidney, small opaque white areas, about 1 cm. or more in diameter, are often seen. These appear to be local thickenings on the capsule at the points of attachment of the fibrous septa, which connect the tunica propria with the perinephric sheath.

Even at these points, the capsule strips very readily, and there is no evidence of any local interstitial change, the cortex appearing perfectly smooth, and bulging through the capsular incision.

Occasionally, rather pale areas may be seen on the renal cortex, but these do not necessarily correspond in position with the capsular thickenings, and are probably pressure effects. On section they show no evidence of fatty change.

There is yet another condition which may be present, a well-marked hydronephrosis, with little, if any, secreting tissue surviving.

The contained fluid is often under considerable pressure, and if the case is operated on during an acute attack, it may spurt out with considerable force, on incision of the sac.

In the acute cases, that is to say, the cases which are liable to "torsion" attacks, it is the obstruction to the urinary outflow that is the chief damaging factor, although vascular changes by no means play a wholly subordinate part.

J. Rose Bradford imitated this effect very closely by experiments upon dogs (*Trans. Path. Soc.*, 1897).

He completely occluded one ureter for periods of 10–40 days, and then drained the affected kidneys by sewing up the proximal part of their ureter to the abdominal wall and making a urinary fistula. After free drainage had been established, in this way, for periods of from 1–7 weeks, he killed the animals, and found that the kidneys quickly resumed their normal shape, but were much diminished in size, in extreme cases consisting of only a quarter of their previous bulk.

The organ, instead of becoming a shrivelled sac as one would expect to find it, appeared as a miniature specimen, microscopically perfect, of its former self. The ureter remained thickened and dilated.

There was no general cirrhosis, but only a slight increase of fibrous tissue along the course of the larger vessels.

He regarded the atrophy as being accounted for by :—

(i) Diminution in size of the renal cells ;
(ii) Disappearance of many tubules ;
(iii) Crowding together of the remaining tubules.

The nuclear staining of the renal cells was not affected, but their protoplasm had lost all its granules, and appeared clear and glass like.

In an experiment of our own upon a cat, we caused complete ureteric obstruction for 48 hours by means of a glass rod placed behind the ureter, and a figure of eight silk ligature lightly applied. At the end of that time we reopened the abdomen, removed the obstruction, and satisfied ourselves that the tube was patent.

The cat was killed 14 days later.

At that time the ureter was found patent, and the most striking feature was the dilatation of the intra and extra-renal portions of the pelvis, and the ureter proximal to the site of ligature.

This early hydronephrosis had been noticed at the second operation, and, so far as could be judged, showed the same amount of dilatation at that time.

Sections of the kidney showed no marked changes with the exception of great vacuolation of the renal epithelium. Fresh sections, stained with Sudan III., demonstrated the fatty nature of these clear glass-like globules extremely well.

We would regard then the small pale movable kidney, showing a slightly dilated pelvis, as one of the earlier stages of Rose Bradford's experimental specimens. Not differing much in outward appearance, capable of recovering themselves to a certain extent on the removal of the intermittent attacks of obstruction, but nevertheless considerably impaired in function. An argument which those, who say that movable kidney is a condition of no importance, must find it difficult to refute.

That hydronephrosis, usually of the intermitting variety, is an effect, but not a very common one, of movable kidney has been shown, both by clinical observation and by experimental work. Terrier and Baudouin collected 83 cases of intermitting hydronephrosis, and found that the more usual cause of this special form of the affection was a floating kidney, which caused a kink in the ureter. One would expect to find the condition more frequent on the right side, if movable kidney played an important rôle in its production, but on the contrary, if anything, it is slightly more common on the left side of the body.

In an analysis of a series of 62 consecutive cases of nephrorrhaphy, performed for movable kidney in St. Bartholomew's Hospital between the years 1899–1905, we found that, in three cases, it is recorded that the renal pelvis was slightly dilated, and, in one only, was a condition of well-marked hydronephrosis present.

There are, however, two fallacies in these statistics :—

(*a*) These patients were all admitted into hospital as suffering from movable kidney, and all well-marked cases of hydronephrosis, having their origin in this, or in some other condition, would not be included in this list, however movable the kidney might be at the time of operation.

(*b*) As we have pointed out before, unless very careful search is made, a condition of early pelvic dilatation may not be noticed. The kidney may be hollowed out in its interior, and yet its external configuration may show little, if any, evidence, either by its size or shape, of this condition, and the extra-renal portion of the pelvis, surrounded by loose fatty tissue, may easily escape notice.

Very careful palpation of the hilum of the gland, or a free incision into its convex border, may be required to demonstrate this condition of early hydronephrosis.

Cases.—The following three cases are typical examples of acute movable kidney, in which hydronephrosis resulted. As they illustrate very well the type of case we are considering, we have given a brief abstract of their notes.

I.—M. A. K., multipara, æt. 62, when first seen, in 1901, gave the history that, for the last few years, she had suffered from intermitting aching pain in the left loin, made worse by any undue exertion. Also that, several weeks previously, she had had an acute attack of pain commencing in the left loin, and radiating down into the left groin and the outer side of the corresponding thigh. The pain was relieved by lying down. There was no hæmaturia or polyuria following the attack. She stated that since this attack her urine had been "thick." She had passed no stone. Her left kidney was found to be prolapsed, very tender on palpation, and abnormally mobile. There was slight albuminuria, and her urine contained a small amount of pus.

The affected kidney was explored from the loin, and was found to be abnormally mobile. Its convex border was incised, and the pelvis was explored. The latter was found to be dilated, and, as there was no evidence of stone, nephropexy was performed.

Her doctor writes, in 1906, 5 years after operation:—

"After the nephrorrhaphy, patient experienced no further acute attack of pain, and the lumbar aching gradually ceased. At the present time she is quite well, and I regard the case as a complete cure. Urine, normal; no albumen or pus."

II.—G. B., a young man, of 22 years, came under treatment in 1901. He stated that for about the last 12 months he had suffered from acute attacks of pain in the right loin, usually accompanied by vomiting. These paroxysms occurred as frequently as once a fortnight, and usually lasted from 2–3 hours. There was no history of a traumatic onset, nor were attacks followed by hæmaturia.

Right nephrorrhaphy was performed, and proved very successful. At the time of operation the kidney, which was very movable, was explored by an incision into the convex border, and was found to be in a condition of early hydronephrosis.

The lumen of the pelvic opening of the ureter was narrowed owing to the oblique direction of the opening of the ureter into the renal pelvis. There was no actual fibrous stricture present.

This patient was seen by us, in July 1906, and his right kidney was found to be firmly fixed in a good position. He had had no pain since the operation, and only a feeling of slight weakness in the right side on severe exertion.

III.—R. A., a multipara, æt. 55, when seen, in August 1900, gave the following history:—

In July 1900, patient had a severe attack of pain on the right side of the abdomen, resembling ureteric colic, and accompanied by hæmaturia. Fourteen days later, a somewhat similar but less severe attack on the left side, but no hæmaturia.

On the first occasion, there was complete suppression of urine for 18 hours, and, during the subsequent 24 hours, patient passed nine pints of dilute blood-stained urine.

On examination, the abdomen was found to be uniformly tender all over. The right kidney, which was felt to be enlarged, was palpable in its whole extent, and was freely movable. The urine contained a trace of albumen, and a very small amount of pus.

On opening the abdomen, the left kidney, except for slight respiratory excursion, appeared normal.

The right kidney, which was freely movable, was in a condition of early hydronephrosis, and its anterior surface was scarred and puckered by fibrous bands. The abdomen was then closed, and the right kidney fixed in the loin by the usual lumbar operation, but before doing so, it was opened in order to exclude the possibility of stone; the ureter, which was also examined, was clear. During the operation, it was noticed that the perinephric fat was tough and adherent, but did not appear to limit the movements of the organ to any great extent. Unfortunately we have been unable to trace the after history of this case.

It will be noticed that all these cases of our series, showing pelvic dilatation, were those, in which a history of so-called tension symptoms was obtained, and which fall into our classification as examples of the acute form of movable kidney, for which Bruce Clarke has suggested the name of acute renal dislocation.

PLATE XV.

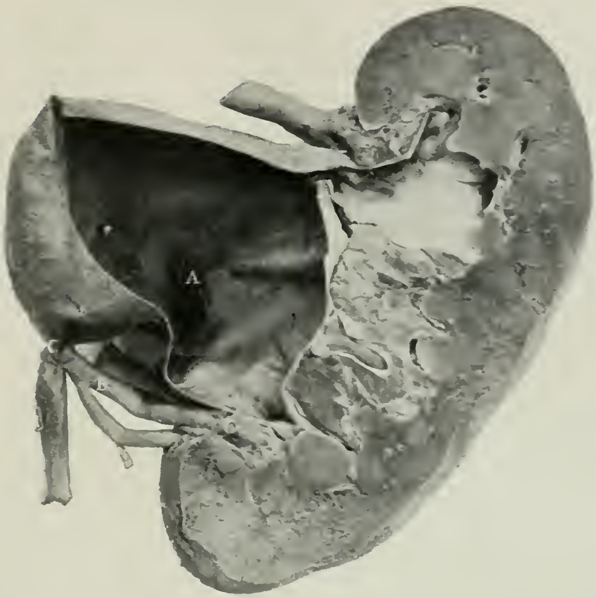
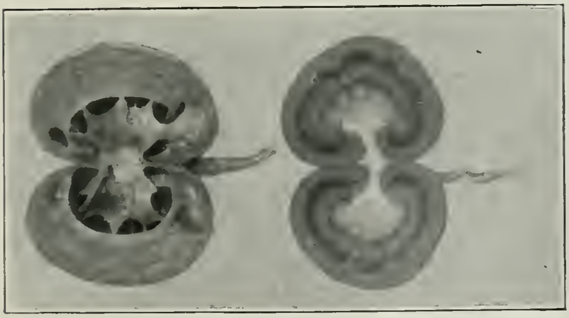


Fig. 4.—*Specimen of a hydronephrotic movable kidney, from St. Bartholomew's Hospital Museum.*

A. *Dilated pelvis and calices.*
B. *Aberrant renal artery.*
C. *Fibrous stricture in ureter.*



A B

Fig. 5.—A. *Kidney (cat) of which the ureter had been completely occluded by ligature six weeks previously.*
B. *Opposite kidney of the same cat.*

N.B.—*In the recent state the hydronephrotic kidney was almost twice the size of its fellow.*

PLATE XVI.

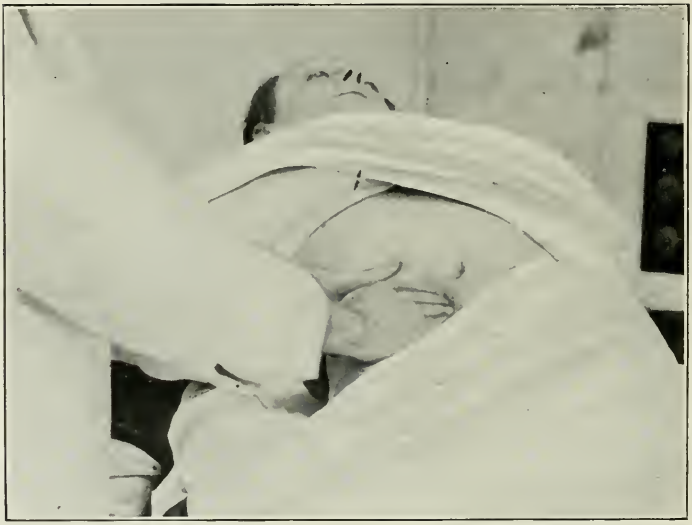


Fig. 6.—“*Abdominal néphroleptique.*”

N.B.—*The patient is lying in a too horizontal position.*

It is comparatively rare to find that a movable kidney has been observed, and its gradual transition into a hydronephrosis has been watched clinically. Morris, however, records one such case in his work on *Surgical Diseases of the Kidney and Ureter.* This was a lady, on whom he operated in 1893, and from whom he removed a left hydronephrosis. Subsequently the right kidney became movable, and this hydronephrotic, and, four years later, nephrotresis was performed with an excellent result.

One case, to which we refer more fully when dealing with the subject of infection, was observed to pass through three stages, movable kidney, hydronephrosis, and eventually pyonephrosis (*see* p. 645).

The clinical observation, that only a small percentage of the cases of movable kidney pass on into a condition of hydronephrosis, receives striking confirmation from the experimental work which has been done on animals. Tuffier found that the production of artificial ureteric curvatures in dogs resulted in hydronephrosis in a comparatively small number of the experiments.

We ourselves, working on cats, failed, in every case, to produce a hydronephrosis by mobilising the kidneys.

The method that was adopted, was to incise the peritoneum in the outer side of the kidney, completely free the latter from its connections, and bring it forwards through the incision, so that it lay free within the abdominal cavity. All loose tissue round the pedicle was removed, and the peritoneum behind the kidney was brought together by a few fine silk sutures, in such a way that no constriction of the renal vessels or ureter was produced.

We found, in some of our experiments, that the object of the operation was defeated by the occurrence of omental adhesions, which prevented free intra-peritoneal movement of the kidney, in one case, the omentum being found completely enveloping the organ. In some, however, no adhesions resulted, and we record the autopsy of one such case, which shows some of the changes that may occur in movable kidney.

Post-mortem Examination Ten Weeks after Operation.—The right kidney was found to be "floating" within the abdominal cavity almost in contact with the anterior abdominal wall. It lay with its hilum looking directly outwards, and its posterior surface directed anteriorly, so that it had rotated round a vertical axis through an angle slightly greater than 180°.

The renal vessels appeared somewhat narrowed, and had been stretched to almost twice their normal length. The ureter described a gentle curve with the convexity outwards, as it passed backwards to the posterior abdominal parietes, but, in the undisturbed condition of the parts, there did not appear to be any acute bend or kink such as would obstruct its lumen.

The segmental subcapsular veins were engorged, and the kidney itself appeared broader, somewhat flattened, and felt flabby, as compared with that of the left side. There was no sign of pelvic dilatation.

Weight of right kidney = 15·46 gms.
Weight of left kidney = 15·08 gms.

Microscopical Examination showed no pathological changes in the renal tissue. The renal capillaries, however, were slightly engorged.

There is one condition which, occurring in association with movable kidney, frequently produces a hydronephrosis, viz., an aberrant renal artery. As the kidney falls forwards, a kink of the ureter, as it curves over the abnormal artery, is produced, and, in some cases, the spur of mucous membrane resulting is quite sufficient to cause renal stasis.

But there is another condition, which is frequently present, and upon which sufficient stress does not seem to have been laid, and that is a fibrous stricture of the ureter at the point at which it is crossed by the abnormal artery. This may so narrow the lumen of the tube that it will only admit a fine bristle with difficulty, and results in the formation of a persistent, rather than an intermittent, hydronephrosis.

For the notes of the following case, we are indebted to C. W. Gordon Watson, under whose care the patient was admitted into the Metropolitan Hospital.

Case.—L. B., a woman, æt. 48, came under observation, in October 1906. She was apparently quite well, up to July 1906, about which time she began to have attacks of pain in the right loin, accompanied by vomiting. A swelling in the right lumbar region was identified as a freely movable kidney, enlarged to about twice its normal size, and this swelling was observed to be gradually getting larger. During the periods of time, intervening between these attacks, she complained of a feeling of local discomfort, nothing more.

There was no history of hæmaturia, or pyuria, nor had she ever passed a large quantity of urine at any one time.

A few weeks later, immediately prior to the time of operation, there was a renal swelling in the right loin about the size of a full time fœtal head.

It was not of uniform consistence, being hard in places, and in other parts feeling elastic and softer. No absolute diagnosis was made, and, as there was a possibility of the swelling turning out to be of a malignant nature, it was thought to be wiser, in the circumstances, to explore from in front. The abdomen was opened by an incision through the right linea semi-lunaris, and a large hydronephrosis was found. The pelvis, which was the part mainly affected, was very tense and thinned out. The dilatation ended abruptly at the lower part of the kidney, where the ureter was kinked, and constricted by an abnormal artery from the aorta running to the lower renal pole, and passing in front of the ureter. There was, in addition, an actual fibrous stricture of the ureter at the site of constriction. Owing to the kidney being movable and displaced downwards, the ureter was acutely bent over the upper border of this vessel. The artery was ligatured and divided.

The pelvis was then gently massaged until most of the urine had been squeezed down to the ureter. This proceeding lasted for about a quarter of an hour, as the urine was with great difficulty forced downwards through the narrowed lumen. The abdomen was then closed, no attempt being made to fix the kidney.

It is usually stated that complete urinary obstruction produces simple, and eventually complete, atrophy of the kidney. Morris says: "It is necessary for the production of a hydronephrosis that the obstruction be incomplete, or, if complete, only temporary, for a complete and permanent obstruction is followed by atrophy of the kidney."

This statement would be quite sufficient to account for the hydronephrosis, produced by kinking of the ureter in some cases of movable kidney, but we would go a step further, and say that a complete and permanent ureteric obstruction always produces a hydronephrosis.

In our animal experiments, we found that complete occlusion of the ureter in cats always resulted in pelvic dilatation, and the production of a hydronephrosis within from 1–5 weeks, and Bainbridge, also working on ureteric pressures after division and ligature of one ureter, records this as an invariable result (*Journ. Path. and Bact.*, January 1901), and showed that complete obstruction of one ureter permanently damaged the secreting power of the renal tubules. On incising the affected ureter proximal to the site of ligature, he found that a considerable quantity of urine at once escaped from the renal pelvis.

It consisted partly of urine, previously pent up in the pelvis, and partly of urine formed very rapidly after the ureter was opened. This fluid was deficient in acidity, and contained a very small per-centage of total nitrogen. After this initial rush of urine had ceased, and it lasted only for a few minutes, the affected kidney appeared to recover its balance, and secreted, at a very slow rate, a very dilute urine, greatly deficient in nitrogenous constituents.

These experimental facts exactly resemble the clinical phenomena observed in a case of torsion of a movable kidney. As the incarceration is relieved, a sudden polyuria occurs, consisting of a much larger quantity of dilute urine than the slightly dilated pelvis could possibly contain, and subsequently a slow secretion of dilute urine from the affected side is shown by the segregator, or catheter cystoscope.

Bainbridge also found that the ureteric pressure steadily and rapidly decreased from the time of ligature, and therefore one may conclude that several attacks of torsion, of 24–48 hours duration, when the distending force is at its maximum, would produce a marked permanent increase in size of the kidney, had not the latter such a remarkable power of recuperation, as Rose Bradford's experiments show it to possess.

Renal Crises (*Dietl*).—The condition, producing the acute train of symptoms known under this title, is usually spoken of as torsion, or incarceration of the kidney.

Bruce Clarke, in a paper read before the Med. Chir. Soc., 1893, proposed to revert to the term of "acute renal dislocation" used by some of the earlier writers, and cited a number of cases, in all of which a definite history of some sudden strain or exertion brought on the paroxysm. But as, in all cases of these so-called crises, there is venous or ureteric obstruction, we think that perhaps the name of renal strangulation is the more appropriate.

Why some cases should be liable to these sudden attacks, whilst in others, in which almost similar physical conditions are present, they never occur, has yet to be explained.

It is not even definitely known why so many cases of movable kidney cause no symptoms at all. Excessive mobility is certainly not the determining factor, because cases are seen in which a forwardly displaced floating kidney, so freely movable that it can be manipulated into the umbilical region of the opposite side, gives rise to not even a feeling of local discomfort.

We think that the true explanation lies in the fact that, in these patients, one renal pole is capable of a much greater range of movement than its fellow. When this has occurred, as the result of some sudden strain (renal dislocation), the kidney may become temporarily fixed in this new position by a piece of gut slipping in behind it and preventing its return to its natural position (renal strangulation).

In the acute cases of traumatic origin, which usually occur in males, it is the upper pole which is at fault in the majority of instances, and these are the patients who experience the more severe symptoms of pain and hæmaturia.

The acquired acute cases, on the other hand, show less severe symptoms, although of the same type, and it is more common to find in them, as a result of the downward hepatic pressure, that the mobility is chiefly confined to the lower pole.

The kidney, therefore, undergoes rotation about its transverse axis, and, in this way, causes obstruction to the venous return.

The ureter also may share in the mechanical disorganisation, and its lumen become obstructed :—

(i) By torsion ;

(ii) If it is the upper pole which becomes displaced, by kinking over the renal vessels ;

(iii) If the lower pole is the one chiefly affected, associated with a certain amount of prolapse of the whole kidney, by kinking and the formation of a spur of mucous membrane at the point at which the ureter pierces the fascia retro-renalis.

However, these two lesions do not always occur together. If the vessels alone are constricted, the following changes are characteristic :—

(i) Secretion of a small amount only of a highly concentrated urine, or even complete suppression, probably due to reflex spasm of the opposite renal vessels ;

(ii) Subsequent secretion, during the following five or six hours, of a large amount of dilute urine containing albumen, tube casts, and perhaps copious hæmaturia ;

(iii) The appearance of a tender swelling in the loin, which is the enlarged kidney ;

(iv) The latter, when exposed, is found to be large, tense, of a dark red or purple colour, and may show, here and there, subcapsular hæmorrhages, causing partial detachment of the capsule. There may also be hæmorrhage into the intermediate zone of the kidney.

In one case of an acute acquired movable kidney, in a young female patient, whom we saw operated upon, these subcapsular hæmorrhages were well shown. For some years she had suffered from dull aching posterior renal pain, and, during the year preceding nephrorraphy, had been subject to acute attacks of renal torsion accompanied by severe attacks of abdominal pain and albuminuria.

These attacks were usually brought on by playing tennis, or some other form of active exercise. Her right kidney felt distinctly enlarged, and, so freely movable, that it could be pushed over into the opposite side of the abdomen with ease. She was operated on a few days after one of these attacks, and, when seen six months later, was completely cured.

Hurry Fenwick,[1] discussing this condition under the title of "Intermittent Strain or Tug on the Renal Vessels," especially in connection with the presence of an aberrant artery to the lower renal pole, says :—

"The lower pole, even the lower third of the kidney, may be seen to be of a dull white colour. This area is sharply marked off from the dull red of the remainder of the apparently healthy cortex. The capsule over the area may strip at a touch, or it may come off with difficulty, and then little patches of the cortex come away with it. This difference in capsular detachment varies according to the age and stage of the patch of nephritis. The cortex of the impaired area is usually smooth, white-greyish-yellow ; it is soft, and tears easily. Section from it shows a fatty change in the epithelium, and a marked state of chronic nephritis. Sometimes the surface of the area is distinctly granular, but I have never seen this change so abruptly limited as the white."

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[1] *Clinical Cystoscopy*, p. 443.

INFECTION OF MOVABLE KIDNEY.

The subject of infection of movable kidney is an extremely difficult one to obtain definite evidence about, but our own clinical observations, and a careful consideration of the experimental work of others, have forced us to the conclusion that it does occasionally result.

In all probability, however, infection and suppuration only occur in movable kidneys which either show pelvic dilatation as the result of ureteric obstruction, or have become secondarily fixed by adhesions to some other abdominal viscus, such as the liver or colon, by adhesions.

The following case is an extremely interesting one, as it shows the unusual sequence of movable kidney, uronephrosis, and eventually pyonephrosis.

A middle-aged woman had for some years suffered from the chronic form of movable kidney, the most prominent symptom being aching lumbar pain. She was seen by a well-known London surgeon, who found a right movable kidney without any evidence of enlargement. No operation was advised. Some considerable time later, she came under the observation of Mr. Percy Paton, to whose kindness we are indebted for an account of the case. Her symptoms had become steadily worse, and, when seen by him, she was found to have a renal swelling of considerable size, which felt cystic in nature, in the right loin. There was no pyuria. On exploration, a large movable pyonephrosis was found, which was removed.

Cultures taken from the pus showed a pure growth of a coliform organism, which was not B. typhosus, nor the ordinary type of B. coli.

Rovsing, of Copenhagen, in the *British Medical Journal* for 1898, part ii., pp. 15–47, has also recorded a very interesting case.

Case.—The patient, an anæmic, emaciated woman, æt. 56, came under his observation in 1897. She stated that she had been perfectly well up to 1885, when, after a fatiguing day's washing, she noticed blood in her urine. The hæmaturia occurred twice in the ensuing 12 years, each time after severe exertion. Her urine contained numerous red and a few white corpuscles, and many small motile bacilli, found on cultivation to be B. coli. A rounded hard tumour on the right loin was thought to be a malignant kidney.

Rovsing explored from behind and found the kidney displaced downwards in a remarkable oblique position, with its upper pole turned towards the vertebral column, the convex border turning forwards and upwards, so that the kidney seemed to have made half a turn on its pedicle. It was kept in this position by the very pronounced lacing-liver, the furrow of which was exactly opposite to the upper edge of the kidney, whilst the latter was behind, and densely adherent to the posterior surface of the liver.

The kidney was enlarged, being especially longer than normal, and was bluish in colour. It was explored by an incision into its convex border, but, except for slight dilatation of the pelvis and some congestion, nothing abnormal was found. A small piece of tissue was excised for microscopic investigation, and the kidney then fixed in the loin, after a somewhat troublesome procedure in freeing it from the liver.

The excised portion of renal tissue showed stasis in the veins and capillary vessels. No infiltration of round cells. In the tubuli recti a number of small staff bacilli. Within three weeks of the operation, the urine was free from blood and albumin, but still contained B. coli; after two months' administration of freely-diluted salol, however, it was found to be sterile.

He records that, one year later, the patient remained in excellent health.

Physical Examination.—A patient, who complains of symptoms which suggest a movable kidney, should, in the first instance, be carefully examined in the recumbent position. In this way a kidney, which is floating in the region of the umbilicus, or even on the opposite side of the abdomen, will not escape detection, and any abnormal condition of the liver as regards its size, configuration, and level will be discovered. This careful palpation of the front of the abdomen, combined with bimanual renal examination, will also give a valuable standard for comparison with the changes which gravity produces in the second position.

Theoretically, the ideal position of the patient for the examination of a condition, which is so largely influenced by gravity, is the standing posture, but, practically, this method does not fulfil one's expectations. In the first place, it is not usual, and women do not like it, an important point in dealing with patients of the better classes ; and secondly, any advantage which may be derived from this position, is more than counterbalanced by the rigidity of the abdominal muscles. Even when the patient is stooping forward, complete abdominal relaxation is difficult to obtain. In our opinion, the most satisfactory practical procedure is to place the patient on a couch, the back of which is raised through an angle slightly less than 45°, and, in this position, adopt the method of examination described by Glénard under the title of "abdominal néphroleptique." Failing a couch of this description, the patient's shoulders may be well raised by means of pillows, and the head bent slightly forwards and well supported. This latter point is very important, for if any strain is thrown upon the muscles of the neck, as evidenced by the prominence of the sternal heads of the sterno-mastoids, the condition of the abdominal muscles will prove far from satisfactory. If in this position, combined with slight flexion of the corresponding thigh on the abdomen, some cause, such as excessive nervousness on the part of the patient, defeats the purpose of examination, then, we think, it is wiser to give a general anæsthetic, and secure an efficient investigation in this way.

Glénard has somewhat happily described his method as consisting of three stages :—

(1) The lying in wait.
(2) The capture.
(3) The escape.

Suppose, for the sake of example, it is the right kidney which it is desirable to examine. The surgeon sits on the affected side of his patient, and places the palm and fingers of his left hand behind the patient's right loin, the tips of the fingers reaching well up into the renal angle; before anything further is done, as great relaxation as possible of the abdominal muscles is secured, and the patient is directed to allow all her weight to rest on what should be the "supporting hand." The right hand is then placed on the front of the affected loin, the tips of the fingers being directed upwards and outwards, towards, and, if necessary, underneath the right costal margin, and bimanual pressure is then made. This must be gentle at first, until the patient's confidence is secured, and then the right finger tips press more and more deeply with each succeeding expiration until the kidney is "caught" and palpated.

If the affected organ is freely movable and prolapsed, by carrying forward the thumb of the left hand on to the front of the loin, immediately beneath the costal margin, and squeezing the lumbar region during a deep inspiration, the kidney can be fixed in its prolapsed condition.

This manœuvre sets free the right hand, which may be used for more accurate and careful palpation at the surgeon's leisure to determine not only the size and shape of the kidney, but also to thoroughly investigate any inward rotation of the lower renal pole.

When the left kidney is examined, it must be done from the left side of the patient, for it is a fatal mistake to lean across and attempt to make the examination from the right side.

The amount of anterior renal displacement must be noted by a supplementary examination, with the patient lying on the sound side in the semi-prone position, as if for a right lumbar exploration.

We do not think the proper physical examination of a kidney is so simple and easy a matter as most of the text-books would seem to indicate.

In one of the most severe acute cases we have seen, occurring in a man, in whom violent attacks of pain and hæmaturia were of frequent occurrence, the affected kidney, which was the left, although found at the time of operation to be freely movable, could not be identified by repeated previous examination.

One word of caution is necessary. If a freely movable and prolapsed kidney is fixed in its abnormal position with the "supporting hand," and palpated with the other, an exaggerated impression of its size is very apt to be obtained. At the time of operation we have repeatedly seen kidneys with no sign of enlargement, which had previously been recorded in the notes as feeling considerably larger than natural.

Occasionally, also, we have found that an efficient examination, as described above, has produced an attack of posterior renal aching which has lasted for as long as 12–18 hours, and has been sufficiently severe to necessitate the patient lying up.

As we have pointed out before, "loss of expiratory return," although indicative of stretching of the perinephric fascia, is no guide to the occurrence or absence of true renal symptoms ; also that inward rotation of the lower renal pole, although a much more valuable sign, is of itself by no means infallible.

We have never felt the pulsation of the renal artery as described by some writers.

(*To be continued.*)

THE OPSONIC TREATMENT OF PULMONARY TUBERCULOSIS BY TUBERCULIN.

A RECORD OF SEVENTEEN CONSECUTIVE CASES.

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The only satisfactory test of the efficiency of any therapeutic measure is the result of the treatment of a large number of cases of all degrees of severity, after the lapse of an interval of time sufficiently long to allow of the appearance of any recrudescence of the disease in cases of apparent cure. It is as yet impossible to apply such a test to the opsonic treatment of pulmonary tuberculosis by injections of tuberculin.

In the great mass of literature, which has appeared on the opsonic index and its practical application, one seeks in vain for any record of the results obtained in the treatment of a large series of cases. I have, together with Dr. A. Parkin, already recorded (*Lancet*, October 27, 1906), a series of 34 cases of infection by various organisms, treated by the injection of bacterial vaccines, but, in this paper, I intend to confine myself to 17 cases of pulmonary tuberculosis, forming part of over 70 cases treated by opsonic methods.

For several reasons, this series of cases appears to have special value. In the first place, there are cases of all degrees of severity, comprising early stages of the disease (Cases 4 and 13), old-standing, chronic cases (Cases 6 and 14), and cases (Cases 3, 8, 11, 12, and 16), in which the disease was far advanced, and the condition desperate.

In this series, I have included only those, in which the treatment was commenced more than six months ago, but all such cases have been recorded, whatever result was obtained by treatment. In Cases 5 and 6 all treatment ceased over nine months ago, in Cases 2 and 4 more than 15 months ago, so that here sufficient time has elapsed to form some judgment of the permanency of any benefit produced.

In addition, all the cases have been treated in private practice, and the advantages of hospital, or sanatorium, life, in the control of diet, of rest and exercise, and of fresh air have accordingly been absent. In some of the cases (Cases 3, 9, 10, and 16), the unsatisfactory home surroundings have greatly militated against success, and the impossibility of securing proper hygienic and dietetic conditions, in Cases 3 and 10, led to the abandonment of the treatment at an early stage. In spite of the fact that all treatment has had to be carried on at home, advantage has been taken, wherever possible, of any remedial aids which experience could suggest, such as strict attention to diet, the proper ordering of rest and exercise, and as much fresh air as could be obtained in the house, the back garden, or by temporary residence in the country, or at the seaside. Cod-liver oil, occasional tonics, and the treatment appropriate to such complications as hæmoptysis, were the only other remedies used.

Almost all the patients have been able, or compelled, to carry on their usual occupations, in some cases very trying ones, during the whole or greater part of the treatment.

In judging of the value of the treatment, the above facts must be taken into consideration, for they have undoubtedly added to the difficulty of producing good results, or have seriously retarded progress. At the same time, the fact of being able to carry on the treatment with the patient at home, or at work, increases its usefulness, for, in most of my cases, the necessity of earning the daily bread has been a pressing question.

All the cases have been treated by the injection of Koch's new tuberculin, T.R., and the opsonic index has been the only guide to treatment. An opsonic chart has been kept in each case, showing the rise and fall of the opsonic index, and this has been applied clinically just as a temperature chart would be.

As to the details of routine, it is difficult to state what dose of tuberculin should be given in any particular case, and at what intervals this should be repeated. Patients differ so much in their reaction to tuberculin that no fixed rules can be laid down ; each case must be treated on its merits.

The plan I have adopted has been, first, to establish the diagnosis from the symptoms, clinical signs, by examination of the sputum, and by estimation of the opsonic index.

Tubercle bacilli were found in the sputum in 15 of the cases. The opsonic index was estimated two or three times before commencing any treatment, so that some idea of the patient's reaction to auto-inoculation might be obtained.

A small dose of tuberculin is then injected, and the opsonic index worked out sufficiently often to show the effect of it. In this way information is obtained of the duration of the negative phase, if present, and of the period and amount of the maximum reaction. If a good reaction is produced, the same dose is injected again when the index shows signs of falling, but, if the reaction is only small, a larger dose is given. By carrying on this process two or three times, I can find the minimum dose that is necessary to maintain the index well above normal for a good length of time, and, at the end of that time, I give another injection. At the commencement of treatment, it is necessary to estimate the opsonic index at frequent intervals, until the amount of dose and periodicity, proper to each case, are arrived at. Then the injections can be given regularly, at such intervals, with occasional estimations of the opsonic index to assure one's self that the index is being maintained at a satisfactory level. Such a routine may not be the ideal one, but it is the best that I have been able to work with many claims on professional time.

Experience of a large number of cases shows that, by such a scheme, the injections can be spaced so as to maintain the index above normal for considerable lengths of time in the more chronic cases. In the acute ones, this is more difficult, but here the opsonic index must be estimated more often. It is impossible, in practice, to obtain a summation of positive phases reaching a great height as would appear capable of production on purely theoretical grounds.

I am as yet not only not inclined to abandon the use of the opsonic index in carrying out the treatment, but consider careful attention to the patient's reaction, as shown by the index, to be essential to successful vaccine treatment.

The tuberculin, which I have used, is obtained from Meister, Lucius, and Brüning, of Hoechst am Main. For use it is diluted with a sterile solution of 0·5 per cent. carbolic acid, so that 1 cc. contains $\frac{1}{500}$ milligram of solid substance. The mixture is then sterilised at 60° F. The dilution from stock is made every 14 days, so that the injection fluid is always fresh.

Roughly speaking, the doses, which I have used, varied from $\frac{1}{400}$ milligram to $\frac{1}{2000}$ milligram, and the periodicity of injection has varied from 4 to 21 days.

It is, I believe, generally thought that no case should be injected, if the opsonic index, on a single occasion, is found to be high, but, in some of my cases, treatment was commenced even if on one occasion the index for the tubercle bacillus was found above normal. Apparently these cases have done equally as well as those in which the index was persistently below normal. As a matter of fact, it is only in the acute or active cases of pulmonary tuberculosis that the opsonic index is likely to be high, *i.e.*, above, say, 1·3; for, if these cases are examined often enough, they will be found, not to remain constantly high for any long period, but to show "high phases" and "low phases," corresponding with waves of auto-immunisation. During the "low phases," the patient will presumably be getting worse, although the mean opsonic index may be above normal. What I believe, and my charts certainly seem to show it, is that, by means of tuberculin administered at proper doses and at proper intervals, the index can be maintained for long periods above normal without many "low phases," and the patient derives benefit in consequence. By refusing to treat a case, which, on a single examination, shows a high index, is to cut off from treatment many cases which might benefit, for a high index shows that the patient's immunising apparatus is not yet exhausted, as may possibly be the case, in which a persistently low index is found.

The clinical result of the tuberculin injections in the successful cases has been to produce a great improvement of the general health, a gradual fall of the evening temperature, a return of the appetite, and an increase in the patient's weight. The largest increase in weight was in Case 8, where the patient put on 35½ pounds. An increase in the percentage of hæmoglobin, and in the number of red-blood corpuscles, is generally an early result, and a pale, anæmic complexion is replaced by a good healthy colour. The cough gradually becomes less troublesome and the amount of sputum reduced. In some cases, in which the sputum is examined often, the tubercle bacilli can be found to become fewer, and finally none are found at all. The physical signs of active disease become less marked, and, in cases, in which the lung destruction has been great, are replaced by signs of fibroid change. In some of the slighter cases, all abnormal auscultatory sounds in the lung disappear. Where the patient is doing well, a gradual fall of the evening temperature is one of the most striking features, and I have observed in some that the evening temperature has fallen a degree or so during several days immediately following an injection, to rise again slowly as the next injection became due, after which a further fall has taken place. This is only seen in some cases, and the fall of temperature is quite independent of the opsonic index. The temperature is not a trustworthy guide to treatment.

In recording these cases, I have made no attempt to classify them in any way according to the result obtained. The order observed is a chronological one, the cases being numbered in the order in which they came under treatment.

Case 1.—The patient, a male, aged 31 years, was sent by Mr. E. H. Howlett, and was first seen on January 29, 1906. There was a history of cough and loss of weight for the previous 12 months. Improvement took place during three months' sanatorium treatment, but later a relapse took place. When seen, he was going rapidly down hill, had a troublesome cough, with copious expectoration, and an evening rise of temperature to about 100°–101° F. There were tubercle bacilli in the sputum and at times blood streaks. The physical signs were those of consolidation at the apex of the upper and lower lobes on the left side, and, in a less degree, of the apex of the uppermost lobe on the right side. The tuberculous opsonic index taken, on two occasions before treatment, was 0·84 and 0·85. Weight, 13 stones 10 lbs. The patient has been under treatment for one year and nine months, during which time he has received 55 injections of tuberculin, and 67 estimations of the opsonic index have been made. After the first ten months of treatment, the patient's condition greatly improved, the cough and expectoration decreased, and no tubercle bacilli could be found in the sputum. He then had a relapse as the result of exposure and chill, and the disease extended over the greater part of the left lung, and became active on the right. During the last five months, the condition has gradually but slowly improved, and is now better than it has ever been previously since treatment commenced. The evening temperature is never above normal, the cough is very slight in the morning, with hardly any sputum, and, only occasionally, are tubercle bacilli to be found. The weight is practically stationary at about 14 stones 2 lbs. There are signs of fibroid change on the left side of the chest, but active mischief is not apparent; on the right side there are râles to be occasionally heard at the apex in front. The result in this case would, I think, have been better, but for the fact that the patient is compelled to earn his living, and this entails long hours in a large drapery establishment; still he manages to improve steadily, although all other treatment was of little use.

Case 2.—The patient, a female, aged 39 years, under the care of Dr. A. T. Brand, of Driffield, came under treatment on February 16th, 1906. There was a history of failing health, loss of weight, cough, and expectoration for six months. The patient was confined to bed, and there were evening rises of temperature and night-sweats. Tubercle bacilli were found in the sputum. On examination, there were physical signs of consolidation at the apices of the uppermost and basal lobes on the right side, and some deposit at the same base behind. The tuberculous opsonic index before treatment was 0·75, and, during treatment, a maximum of 1·63 was recorded. Between February 19 and June 1, 1906, ten injections of tuberculin were given, and 22 opsonic estimations made. The cough and expectoration entirely disappeared, the patient gained 19 pounds in weight, and all abnormal physical signs in the chest entirely cleared up. It is now 15 months since the last injection was given, and the patient has been going about her ordinary life apparently perfectly well. The last report from Dr. Brand is that she is quite well, the weight fully maintained, and all symptoms absent.

Case 3.—The patient, a female, aged 16 years, was first seen on March 19, 1906. There was a history of steadily advancing disease for four years. Brief sanatorium treatment had done no good, and, when seen, the patient was in a desperate condition. She had almost constant cough, with large quantities of purulent sputum, loaded with tubercle bacilli. The evening temperature reached 102·5° F., with copious night-sweats. Vomiting took place after almost all food, and diarrhœa was troublesome. There was a large cavity at the apex of the left lung, and the whole of the remainder was diseased. There were signs of deposits at the apex of the uppermost lobe on the right side, and pleuritic signs at the base. The pulse was over 110 per minute, and the heart was considerably displaced. The tuberculous opsonic index before treatment was 0·85, and two days later 1·04. A maximum of 1·8 was recorded during the treatment, which was continued for ten weeks, seven tuberculin injections being given, and ten opsonic estimations made. The patient at first seemed to gain some benefit from treatment and put on four pounds in weight, but an empyema formed for which operative measures were refused, and treatment was consequently discontinued. The home surroundings were also most unsatisfactory. I saw the patient on April 13, 1907, when she was steadily becoming worse, and I am informed that she died on May 26. The patient was only treated for a very short time, but, considering the extremely unsatisfactory circumstances in which the patient was placed, and the very extensive disease, the case seemed hopeless from the first.

Case 4.—The patient, a male, aged 27 years, was under the care of Dr. Angus Fairweather of Pocklington, and was first seen with Drs. Fairweather and Parkin on March 20, 1906. He had been failing in health, and had lost nine pounds in weight during the previous six months. There was some cough with expectoration, which was at times blood stained. The physical signs were those of a deposit at the apex of the right uppermost lobe. In addition, the patient had a breaking-down gland, with a sinus leading to it, on the right side of the neck. The tuberculous opsonic index before treatment was 0·82, and was raised by injection to a maximum recorded of 1·55. The index for the staphylococcus pyogenes aureus was estimated, and found to be 1·0. During treatment, five injections of tuberculin were given, and the opsonic index was estimated on eleven occasions. The patient was only treated for seven weeks, but in this time he gained 13 pounds. The gland enlargement disappeared, and the sinus healed. The physical signs, when the chest was last examined, absolutely negatived the existence of any active disease. It is more than 16 months since the last injection was given, the patient has been at work, he looks perfectly healthy, and says he never felt better in his life. The treatment in this case shows what can be done when the patient comes under treatment at an early stage of the disease.

Case 5.—The patient, a male, aged 44 years, was first seen with Dr. J. B. Close, of Hull, on April 6, 1906. There was history of cough and occasionally blood-stained sputum for six months. The patient had lost nine pounds in weight. On two occasions, there had been severe hæmoptysis. Digestion very much out of order. The physical signs were those of consolidation at the apices of the upper and lower lobes on the left side, and, in a less degree, at the uppermost lobe on the right side. Tubercle bacilli were found in the sputum. The tuberculous opsonic index before treatment was on two separate occasions 0·82 and 0·62. The maximum recorded during treatment was 1·74. Between April 17 and December 24, 1906, there were 22 estimations of the opsonic index, and 18 injections of tuberculin were given. By the last date, the patient had increased 17½ pounds in weight, the cough had practically gone, and the physical signs of active disease were no longer present. No tubercle bacilli were to be found in a very small quantity of frothy sputum. The patient was seen on September 14, nine months after the last injection, in better health than he had been for years, the weight was maintained, and the signs of any active disease in the lung were negative. The opsonic index was estimated, and found to be 1·06. The result in this case is very satisfactory, as there has been no relapse since the treatment ceased, although the patient's work is in a stuffy office.

Case 6.—The patient, a male, aged 41 years, was first seen with Dr. E. Harrison, on April 21, 1906. There was a history of pulmonary tuberculosis of six years' duration, with recrudescence during the last seven months. When seen, he had a troublesome cough, with a slight amount of sputum, containing tubercle bacilli, and at times signs of hæmorrhage.

There were slight evening rise of temperature, and a very small loss of weight. The physical signs showed a small cavity at the left apex, with some surrounding consolidation, and a small localised area of deposit at the angle of the left scapula. The tuberculous opsonic index before treatment was 1·39 and 1·37 on two occasions. The maximum recorded reading was 1·9. The pneumococcic index was 0·8. Between April 24, 1906, the date of the first injection, and January 11, 1907, the patient received 18 injections of tuberculin, and the opsonic estimations numbered 30. Though the weight only increased a few pounds, the cough practically disappeared, there was no longer any sputum, and the general health greatly improved. The physical signs denoting active mischief were no longer to be detected. At the same time, as he received the tuberculin injections, the patient was given injections of pneumococcic vaccine, and it was thought that the subsequent progress was more rapid. The patient was seen on September 13, and expressed himself as quite well, and certainly seemed to be so. There were signs of fibrotic changes at the left apex, but no indications of active disease. The tuberculous opsonic index was found to be 0·89.

Case 7.—The patient, a male, aged 34 years, sent by Dr. F. N. Stewart, was first seen on May 28, 1906. There was a history of failing health, with loss of weight, cough, and expectoration for over nine months. The evening temperature was slightly raised, and there were night-sweats. The sputum was, at times, hæmorrhagic, and contained tubercle bacilli. There was an unfortunate complication by recent leutic infection. The physical signs were those of consolidation at the apices of the uppermost and basal lobes on the right side, and some deposit at the left apex. The tuberculous opsonic index was 0·65, and two days later, 1·05. The patient has been given 34 injections of tuberculin, and 39 opsonic estimations have been made. During the first seven months of treatment, the opsonic index was never found below normal on a single occasion, and during this time, he made very good progress. Active mischief was apparently arrested, the cough and expectoration almost ceased, and there was a gain in weight of 12½ lbs. The patient felt so well that the treatment was suspended, and contrary to advice, he went to follow his occupation as a ship's officer, with the result that, after two voyages across the North Atlantic in winter, he returned with a severe relapse. The cough and sputum increased, there was a rapid spread of disease in the lungs, and he lost, during the next five months, 14 pounds in weight. The opsonic index had fallen, on one occasion, to 0·51. During the last three months, the condition has been improving slowly, the cough is again less, and also the sputum. A few pounds have been regained, and the physical signs show improvement. The great difficulty experienced in regaining the lost ground makes one regret that the patient was ever allowed to suspend the treatment, and take great risks, after the satisfactory progress of the first seven months.

Case 8.—The patient, a male, aged 30 years, was under the care of Dr. A. Parkin, and was first seen on August 4, 1906. There was a history of rapidly progressing disease for about four months, during part of which time he had been under the care of Dr. H. Towers, of Leeds. The patient was desperately ill, the evening temperature was as high as 104° F., sweating was profuse; he had a racking cough, and had lost over 14 pounds in weight. He was so ill that, on arriving in Hull, he was in a state of collapse. On examination there were signs of affection of practically the whole of both lobes of the left lung, with breaking down at the apex of the upper lobe, and consolidation and signs of pleurisy at the base. There were a few râles to be heard over the right apex behind. The heart's apex was well outside the left nipple line, the pulse was over 120 per minute, and he was cyanosed and breathless on the least movement. Tubercle bacilli were found in the sputum. The tuberculous opsonic indices recorded before treatment were, on August 4th, 1·33; on the 7th, 0·62; and on the 8th, 1·23. The patient was under treatment in a nursing home for 12 weeks, during which time the improvement was marked. The evening temperature, at the end of this time, did not rise above 99° F., the cough and expectoration were much less, the cardiac embarrassment and pulse rate were less. The patient looked a different man, and was able to get about. The improvement in the physical signs was very marked, the amount of active disease being very small. The patient was sent to Bridlington on October 30, and, under the care of

Dr. J. J. Coleman, the treatment was continued until March 30, 1907. The improvement was wonderful, and continued to August 20, when he sailed to Australia to work on a sheep farm. I saw him in the early part of August, four months after the last injection, and he was hardly recognisable as the wreck who had come under treatment a year before. He had occasional cough, and, at times, a little sputum early in the morning, but the evening temperature was normal. He had gained 2 stones 7½ pounds. The physical signs showed no active disease in the lung on either side, whilst on the left there seemed to have been a fibroid change taken place. The excellent result in this apparently hopeless case was not only unexpected, but is most encouraging.

Case 9.—The patient, a female, aged 29 years, under the care of Dr. A. Parkin, was first seen on August 13, 1906. She had never been well since her confinement, 12 months previously, but, during the last four months, the failure in health and loss of weight had been marked. There was a bad family history of phthisis, and the home surroundings were most unsatisfactory. The patient was very neurotic and difficult to manage. When seen she had a troublesome cough, with slight expectoration, and there had been a loss of weight of two stones. The evening rise of temperature was small, and there were occasional night-sweats. On examination the abnormal physical signs were not marked, defective resonance was present over the left apex in front, with defective vesicular murmur, and a few scattered râles. Tubercle bacilli were found in the sputum. The tuberculous opsonic index was 0·95. Between August 15, 1906, and February, 1907, the patient was given 20 injections of tuberculin, and 34 estimations of the opsonic index were made. The result of the treatment was never satisfactory; at first she seemed to improve slightly, but, at the end of seven weeks, had severe hæmoptysis, and another attack four weeks later. After this, the condition became gradually worse, and, by the end of three months, it was noted that the disease had spread to the right side of the chest. She was removed from her unfavourable surroundings to the seaside, and the injections were suspended for five weeks, but the condition became worse, the weight being now only five stones. The patient was then taken to a nursing home, and the injections resumed, but she gradually grew weaker. Both lungs were now wholly affected, vomiting and diarrhœa became frequent, and, on February 23, she died. The last injection was given six days before death. The opsonic index four days before death was 0·9, and nine days before 1·73. During the whole of the treatment the opsonic index was only found below normal on six occasions. It is difficult to account for this unfortunate case, except by the facts that the patient's vitality seemed to be very low, and that the home surroundings were most unsatisfactory.

Case 10.—The patient, a female, aged 55, under the care of Dr. C. H. Milburn, was first seen on October 25, 1906. There had been five months' history of failing health, loss of appetite and weight. On one occasion, there was severe hæmoptysis. The cough was troublesome, and the sputum contained tubercle bacilli. Digestive functions were a great source of trouble. A rise of temperature took place each evening, and there were night-sweats. The physical signs showed consolidation at the apices of both lobes on the left side, and also at the apex on the right. The tuberculous opsonic index before treatment was 0·85. Only four injections were given, and eight opsonic estimations made. After six weeks' treatment, the injections were discontinued, although some little progress seemed to have been made. I am informed that the patient gradually became worse, and died on April 13, 1907. In this case, the duration of the treatment was too short for any good result to be obtained from the tuberculin injections.

Case 11.—The patient, a female, aged 23 years, was first seen on November 17, 1906. Five and a half years previously she had commenced to show failing health, attended with cough and expectoration. A visit to Ventnor produced marked improvement, and the patient remained almost well up to three years ago. At this time, the glands on the left side of the neck began to enlarge, and the cough and spitting recommenced. During the last five months, the condition had gradually become worse, and, when she was seen, it was serious. The weight was only 6 stones 3 pounds, she was cyanosed, and there was dyspnœa on the slightest exertion. The cough caused a lot of trouble, and tubercle bacilli were found in the sputum. The evening temperature rose to 103° F., and the pulse was over 100 per minute. A complication was caused by a sinus in the mouth leading to a patch of necrosed bone in the lower jaw, for which an operation was later found necessary. The physical signs were those of a cavity at the left apex, with extensive deposits in both left lobes. On the right side, there was consolidation at the apex of the uppermost lobe, and at the base on the same side. On both sides of the neck were masses of enlarged glands and lymphatic chains, those on the left being much the larger. The opsonic index for the tubercle bacillus was 1·07. The patient is still under treatment and, to date, 31 injections of tuberculin have been given, and 40 estimations of the opsonic index made. Though the case was an advanced one, improvement has taken place. The evening rise of temperature rarely reaches 100° F., the dyspnœa has almost gone, and the patient is able to walk about. The cough is not troublesome, and the sputum very small in amount. The weight has only increased 3½ lbs. The glands are reduced in size. The physical signs show that the active disease is much less on both sides of the chest, on the right being very little in evidence. The cavity at the left apex shows signs of surrounding fibroid change. Considering the rapidly advancing and extensive disease, the result in this case is not discouraging.

Case 12.—The patient, a male, aged 20 years, was first seen, on December 7, 1906, with Drs. Parkin and McWillie. There was over three and a half years' history of pulmonary affection. Patient had two periods of residence in South Africa, and two months in a sanatorium. Hoarseness commenced nine months ago. When seen, there were troublesome cough, with sputum containing tubercle bacilli, evening rise of temperature, and night-sweats, poor appetite, and frequent attacks of dyspepsia. On examination, there were physical signs of extensive consolidation at the apices of both lobes on the right side, with a cavity at the apex of the uppermost lobe. On the left side, there were deposits at the apices of both lobes. The left vocal cord and arytænoid were œdematous and ulcerated, and there was marked aphonia. The tuberculous opsonic index, on two occasions, was found to be 1·54, and, ten days later, 0·84. The patient has been given 24 tuberculin injections, and 27 opsonic estimations have been made. There has not been any marked progress under treatment, the cough and expectoration are, if anything, less, but the laryngeal condition remains as before. The evening temperature is not raised above 99° F. When last seen, the physical signs showed no improvement, and there had been a loss in weight of 5 pounds since commencing treatment. Though one had hoped for a better result in this case, the extent of disease and the general condition of the patient did not afford much hope of being able to do much good.

Case 13.—The patient, a female, aged 19 years, was first seen, on December 24, 1906, with Dr. George Lamb. There was a history of indifferent health for some months with slight cough, but, during the last three or four weeks, the cough and expectoration had been more frequent and troublesome. The evening temperature rose to 103° F., and there were copious night-sweats. Some loss of weight had taken place. The family tuberculous history was a bad one. On examination, there were signs of deposits at the apex of the left upper lobe, and, in a less degree, at the apex of the lower lobe on the same side. No tubercle bacilli were found in the sputum. The tuberculous opsonic index was found to be 1·19, and, four days later, 0·89. The patient has had 19 injections of tuberculin, and there have been 28 estimations of the opsonic index. Rapid improvement took place after commencing treatment, the evening temperature quickly fell to normal, the cough and expectoration ceased, and the general health greatly improved. The weight increased 12½ pounds. The physical signs now show no departure from the normal, and the weight is maintained. The patient is at work school teaching, and is apparently in the best of health. This case shows the amount of good which which can be effected by this treatment, if the cases only come under treatment early enough.

Case 14.—The patient, a male, aged 43 years, under the care of Dr. A. T. Brand, was first seen on January 6, 1907. There was a history of chronic phthisis for eighteen years, with improvements and relapses. On three separate occasions, he had been resident in South Africa for various periods. When seen, there had been troublesome cough for several months, with large quantities of sputum containing tubercle bacilli. There was slight loss of weight. The physical signs were those of consolidation at the apices of the uppermost and basal lobes on the right side, and, in less degree, at the apex of the upper lobe on the left side. At the right base behind, there were signs of plastic pleurisy. The tuberculous opsonic index, before treatment, was 0·66. Up to the present date, 22 injections of tuberculin have been given, and 30 estimations of the opsonic index made. The patient has made good, though slow, progress under treatment; the cough is very much less, and the amount of sputum reduced. No tubercle bacilli could be found in last specimens examined. The physical signs show that the active disease, on the left side, is in abeyance, and, on the right side, decidedly less. During the last month, a complication has been caused by an attack of acute prostatitis (not tubercular), which has somewhat delayed progress. The prognosis in this case is, I think, promising.

Case 15.—The patient, a male, aged 31 years, was first seen with Dr. A. H. Johnston, on February 8, 1907, when there was a severe attack of hæmoptysis. There was a history of intermittent cough, with slight expectoration, and of two previous attacks of hæmoptysis. Ten pounds in weight had been lost. The physical signs were those of deposits at the left upper lobe, at the edge of the lung overlapping the heart, and a limited area of consolidation at the angle of the left scapula. Tubercle bacilli were found in the sputum. The tuberculous opsonic index, on two occasions before treatment, was 0·73 and 1·03, and the maximum recorded, during treatment, was 2·04. Twenty injections of tuberculin were given, and 29 estimations of the opsonic index made. During the first six weeks of treatment, there were three more severe attacks of hæmoptysis. The patient is now at work and in excellent health. There is no cough or expectoration, and no trace of blood has been seen for six months. The weight has increased 14 pounds. The physical signs of any disease in the chest are now entirely negative. On the last occasion, the sputum was examined, and no tubercle bacilli were to be found.

Case 16.—The patient, a male, aged 19 years, was sent by Dr. F. N. Stewart, and was first seen on February 15, 1907.

There was a six months' history of rapidly failing health, cough, and expectoration. He had an evening rise of temperature, night-sweats, hoarseness, and loss of weight. The appetite was bad, and he had occasional vomiting. Dyspnœa was present, and the pulse rate was 110 to 120 per minute. The physical signs showed extensive consolidation at both apices, that on the right being most extensive. There was a cavity at the apex of the upper lobe on the right side. A few scattered râles were heard at the left base behind. The voice was reduced to a whisper, and the epiglottis, left ventricular bands, and base of the arytænoids were œdematous. The sputum contained tubercle bacilli. The opsonic index, before treatment, was 1·06, 1·24, and 1·63 at intervals of five days. The patient is still under treatment, but 20 injections have been given, and 31 opsonic estimations made. During the first seven weeks of treatment the patient improved somewhat, the weight increased seven pounds, the cough and sputum were less, and the laryngeal condition improved. During the following two months, he had three attacks of hæmoptysis, and the general condition became decidedly worse. He lost 11 pounds in weight, and the disease was apparently rapidly progressing, the dyspnœa and vomiting were at times severe. During the last month, there has been considerable improvement since the patient has been removed from his unfavourable surroundings. Four pounds of the weight have been regained, and the active spread of the disease seems arrested. No blood has been seen in the sputum since August 20. The patient is still in a serious condition, and the result of the treatment, in this rapidly advancing case, cannot be called very satisfactory.

Case 17.—The patient, a female, aged 30 years, was first seen on March 9, 1907. She commenced to exhibit failing health, with cough and expectoration, three years previously. Hoarseness was one of the earliest symptoms. The loss of weight was 2½ stones. There was a bad family history. When seen the patient was rapidly going down hill. The cough was very troublesome, with copious sputum, and there were evening rises of temperature to over 101° F. and night-sweats. Voice hardly above a whisper. Three months' sanatorium treatment had produced very little benefit. There were physical signs of a cavity at the apex of the left upper lobe, with extensive surrounding consolidation. The left lower lobe and the right uppermost lobe were also affected. The left arytænoid cartilage, left vocal cord, and the epiglottis were œdematous and ulcerated. Tubercle bacilli were found in the sputum. The opsonic index before treatment was, on two separate occasions, 1·35 and 1·16. Fifteen injections of tuberculin have been given, and 19 opsonic observations made. There has been marked improvement in the general health, instead of being pale and anæmic, she has a good colour, and looks well. There has been a gain in weight of 11 pounds, and the cough and expectoration are much less. The laryngeal condition has improved, but the voice is much the same. The signs of active disease are not now in evidence, and, if the patient continues under treatment, there is every hope of further improvement.

From these records it will be seen that some of the cases (Cases 2, 4, 5, 6, 8, 13 and 15) have undoubtedly done very well under the treatment, whilst others (Cases 1, 11, 14, and 17) have shown most encouraging improvement, which I am compelled to attribute to the injections of tuberculin. Other cases have not done so well, and the question natually arises as to what are the causes of failure to do good.

Probably the first cause of failure is one common to all systems of treatment, and is due to the cases not being submitted to treatment until too late. Here the immunising power may be exhausted, the general nutrition sunk to a low ebb, and the tissue destruction so great that recovery is hardly possible. The treatment in Cases 3, 12, 16, 11, 8, was commenced when the prospect of recovery seemed very remote, but the result in Case 8 is very encouraging, as the condition of this patient was desperate.

Another cause of failure is that the patient could not for economic reasons be removed from the very unfavourable surroundings which may have, in the first instance, predisposed to infection. Also the good food, necessary to repair waste tissues and produce weight, could not be procured, or was not presented in sufficiently attractive forms to suit a capricious appetite. In Cases 3, 9, 10, the unsatisfactory home surroundings formed an almost insuperable obstacle to success.

Failure may also be due to the fact that it is impossible to inject, in each case, a specific tuberculin manufactured from the particular strain of tubercle bacilli. Parkin and I have already pointed out that the greatest benefit, in the vaccine treatment of other than tubercular infections, is derived by injecting the patient with a vaccine made from the particular culture of organism isolated from the patient. In carrying out the treatment, in such cases, it is my invariable custom to use a vaccine so prepared. In practice, it is possible to cultivate the organism, estimate the opsonic index for that organism, prepare a vaccine, and inject the patient, all within 24 hours.

Possibly greater success might be obtained by a similar procedure in cases of tubercular infection, but obstacles are caused by the difficulty of separating the tubercle bacillus, its slow rate of growth, and the technical impediments in the way of preparing tuberculin.

Messrs. Meister, Lucius, and Brüning, who prepare my ordinary tuberculin, are ready to make me tuberculins from the bacilli, isolated from the sputum of any particular patient, but, unfortunately, not less than six months would be required before the tuberculin would be ready for injection.

Another method of preparing a specific vaccine from sputum is suggested in an article by Paterson of Glasgow (*Lancet*, August 25th, 1906). A vaccine is made from the sterilised tuberculous material from abscess cavities, etc., after the extracellular toxines have been washed away. I am now engaged in preparing specific vaccines from sputum by a modification of Paterson's method.

A further cause of failure arises from the presence of a mixed infection by organisms other than the tubercle bacillus. This may not be of much consequence in early cases, but, later, when there is a breaking-down mass of consolidation, or a raggy-walled cavity, the other organisms, pneumococci, streptococci, staphylococci, etc., undoubtedly play a great part in causing destruction of lung tissue. In Cases 6 and 14, benefit seemed to be derived from the injection of a pneumococcic vaccine, in addition to the tuberculin. The plan, which I am now carrying out, is to prepare a vaccine from the mixture of organisms isolated from the sputum, collected under as aseptic conditions as possible, from every case, in which there is breaking-down lung, and inject the patient with this vaccine in addition to the tuberculin. Sufficient time has not yet elapsed to judge of the usefulness of this procedure.

RECTAL FEEDING.

A REVIEW.

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Under certain conditions, it may be imperative, or at least highly desirable, that the administration of food by the mouth should be suspended, and an attempt made to maintain the nutrition of the body by other methods of feeding. Of the several methods which have been practised, subcutaneous, intraserous, and rectal feeding, the latter is practically the most feasible, and accordingly it is very essential to know to what extent the administration of nutriment by the lower bowel may replace the usual method of taking food. At the outset, a sharp distinction must be drawn between the manifestly beneficial effects on the general well-being of the individual, whose condition calls for the administration of nutriment by the rectum, and the degree to which the nutritive requirements of the organism are subserved. In many cases, in which nutrient enemata are well retained, the sense of hunger may be appeased, the mental anxiety of the individual relieved, and the general condition apparently maintained, and occasionally there may be an actual gain in weight. These effects do not, however, necessarily imply that the nutritive requirements of the body are being met by this method of feeding, but, occurring in conditions, in which the tissues are impoverished of water, they are explicable by the absorption of water from the lower bowel, and by the psychical effect of employing a nutritive fluid. On the other hand, a review of the results, which have been obtained by estimating the amounts of the various foodstuffs which can be absorbed from the large intestine, naturally leads to the conclusion that rectal feeding is a poor substitute for oral feeding, that, even under the most favourable conditions, the individual is being subjected to partial starvation.

The method, which has been most generally employed for the purpose of determining the extent of absorption of the several foodstuffs, consists in injecting into the previously cleaned bowel, enemata of known composition, and then estimating each constituent in the residua removed by the next cleansing enema, and taking the difference as representing the amount of each absorbed. The results so obtained by different observers present very considerable diversity, the earlier investigators, in particular, having recorded results which gave to rectal feeding a value that appears, in the light of modern methods, to have been fallaciously high.

Proteids.—Of the native proteids, egg-albumen, has, since a report published by Ewald, in 1887, been looked upon as the most generally useful for rectal feeding. Prior to this, Voit and Bauer and Eichorst found that egg-albumen was practically not absorbed from the intestine of the dog, unless NaCl was added, when it was absorbed fairly well. Following Ewald, Armin Huber, investigating the subject in three individuals, found the proteid absorption for emulsified eggs to be from 29·8 per cent. to 36 per cent., for emulsified eggs plus NaCl, 1 gramme per egg, from 69·5 per cent. to 70 per cent., and, for peptonised eggs, to be from 74·78 per cent. to 76·6 per cent. Subsequent investigations have not, however, confirmed the good results obtained by Ewald and Huber, and close inquiry into their methods shows that these were not free from technical fallacies. Thus Markwald found, in the case of a female with a colonic fistula, that egg-albumen, introduced into the large intestine, remained unabsorbed and underwent no alteration. Plantenga, Kobert and Koch, and Boyd and Robertson also came to the conclusion that egg-albumen is absorbed from the large intestine to a much less extent than was stated by Ewald and Huber. Boyd and Robertson, in a series of careful observations, obtained the following results from the use of raw eggs :—

Absorption.			Nitrogen Excretion.	Nitrogen Balance.
Percentage of Proteid injected.	Proteid grms. per diem.	Nitrogen grms. per diem.		
13·24	9·52	1·54	3·27	− 1·73
16·5	6·87	1·098	5·5	− 4·402
21·44	10·52	1·7	2·68	− 0·98
8·25	3·86	0·618	6·31	− 5·69

The best absorption, in the four cases, being 21·44 per cent. of the albumen introduced, equivalent to 10½ grammes per diem, an amount which proved insufficient to maintain nitrogenous equilibrium, as is shown by the excess of urinary nitrogen over the nitrogen absorbed.

Milk, another very frequent constituent of nutrient enemata, was claimed by Aldor to be well absorbed when sodium carbonate was added to it, and he regarded it as the best food for rectal feeding. His figures, however, scarcely warrant this belief. In his first observation, the percentage of proteid absorbed was 38, while, in his second, on the same individual, it amounted to only 12·6. According to Brandenburg, very little proteid of milk is absorbed from the large intestine. Sharkey, using 400 ccm. of milk in 24 hours, found the absorption of proteid to be 52·4 per cent., or 6·97 grammes, and of fat to be 52·3 per cent., or 7·8 grammes.

Casein, in the form of "Proton," "Nutrose," "Plasmon," "Eucasin," "Sanatogen," has, in recent years, been employed as a constituent of nutrient enemata.

Hoppe claims that 77 per cent. of the proteid of Sanatogen is absorbed. Ehrström, using Proton, a soda-casein compound, found that 82 per cent. to 86 per cent. of the total nitrogen, and 69 per cent. to 81 per cent. of the total phosphorus was absorbed. The enema he employed was composed of milk 150 grammes, glucose 50 grammes, and Proton 15 grammes, the total daily nitrogen absorbed was 3·92 grammes, an amount insufficient to maintain his patient in nitrogenous balance.

Nutrose was found by Brandenburg and Strauss to be absorbed to the extent of 40 per cent. Eucasin, by Strauss, also to the extent of 40 per cent. Experience has shown that these preparations of casein are best retained when administered in 10 per cent. solution.

Fresh ox-serum has been recommended by O. Grünbaum, who, on administering 90 ccm. every four hours, found it to be well absorbed.

Albumoses and Peptones.—The products of proteid digestion may be introduced into the large intestine as such, or digestion may be allowed to proceed in the bowel itself. The latter method was early used by Brown-Sèquard, and by Leube, who injected into the bowel a mixture of minced meat and fresh pancreas. Brown-Sèquard, using two injections per day of 400 to 500 grammes of meat with 150 to 200 grammes of pancreas, maintained three individuals without loss of weight for 5, 6, and 8 days respectively, and a fourth was efficiently nourished for a month. Leube employed enemata composed of 150 to 300 grammes of finely chopped meat and 50 to 100 grammes of pancreas with 150 ccm. of water, and believed that the whole of the nitrogen was absorbed, the residue having the characters of normal fæces.

Edsall and Miller studied very fully two cases of gastric ulcer, employing enemata composed of milk and eggs predigested with pancreatin and containing sufficient NaCl to bring up the percentage to that of normal saline, each case received in this way 400 ccm. of milk and 6 eggs in the 24 hours divided into three enemata. The proteid and nitrogen absorption was as follows:—

Absorption.			Nitrogen Excretion.*	Nitrogen Balance.
Percentage of Proteid injected.	Proteid grms. per diem.	Nitrogen grms. per diem.		
39·88	19	3·041	10·03	− 6·989
47·5	23·816	3·809	12·78	− 8·971

Boyd and Robertson in their series investigated two cases in which peptonised enemata were employed. Four enemata of the following composition were administered in the 24 hours:—Milk 200 ccm., white of one egg, dextrose, NaCl 1 gramme, water to 300 ccm., the mixture being peptonised and sterilised. The proteid and nitrogen absorption was as follows:—

Absorption.			Nitrogen Excretion.	Nitrogen Balance.
Percentage of Proteid injected.	Proteid grms. per diem.	Nitrogen grms. per diem.		
28·9	8·62	1·38	6·87	− 5·49
45·3	13·87	2·22	8·12	− 5·90

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* In their original paper, Edsall and Miller add to the urinary nitrogen excretion the unabsorbed nitrogen of the enema as representing the debit side of the balance, and, subtracting this from the nitrogen absorbed, obtain a fictitiously bad balance. This error has been eliminated from the above table.

These two sets of observations show that, under favourable conditions, the amount of predigested proteid absorbed varies from 28 per cent. to 47·5 per cent. of the amount administered, and a comparison with the previously mentioned results of Boyd and Robertson, using native proteid, shows that with predigestion a somewhat greater percentage absorption is obtained, a result which had been previously demonstrated by A. Huber. Another important result of these observations is revealed by the nitrogen excretion; this, it will be noticed, reaches its maximum in those cases in which the percentage absorption of proteid is greatest, and the result is a maximum deficit in the nitrogen balance, implying that the individual is metabolising his own proteid tissues at a greater rate under these apparently more favourable conditions.

Peptones.—Bial and Brandenburg agree that 10 per cent. solutions of peptones are well absorbed, the former giving the absorption as 50·5 per cent. or, when combined with alcohol, as 66 per cent.

Albumoses.—Plantenga found, in the dog, that 24·1 per cent. of Somatose, administered in 15 per cent. solution with NaCl, was absorbed. Applying this to the human subject, a total daily absorption of 30 grammes of albumose should be possible. Sharkey, injecting 40 grammes of Somatose with 40 grammes of Sanatogen into the rectum in 24 hours, apparently got an absorption of 74·5 per cent., or 51·06 grammes of proteid, using the same mixture, with the addition of ½ oz. of brandy, the absorption reached 75·8 per cent., results which, if free from fallacy, indicate the possibility of much greater quantities of proteid being administered by the bowel than would appear from the investigations of Edsall and Miller, and of Boyd and Robertson.

It is of interest to note that von Noorden has suggested the use of the ultimate products of proteid digestion—the amido acids—as probably being better absorbed than native proteids, peptones, or albumoses; as yet, however, this has not advanced beyond the stage of speculation.

In attempting to estimate the value of proteids in rectal feeding, it must be realised that the method, by which these results have been obtained, assumes that the whole of the proteid, which disappears from the bowel, has been absorbed in an utible form, and does not allow for the possibility of bacterial decomposition into products, which have no nutritive value. An attempt has been made by Edsall and Miller to determine this point by estimating the conjugate sulphates excreted in the urine during rectal feeding. In their two cases, they found these to be considerably in excess of the normal, as much as two or three times the normal amount in the second case, in which there was apparently much better absorption taking place.

It would thus appear that the results, set forth above, may represent proteid absorption from the large intestine at a fictitiously high level.

In any case, it is obvious from those investigations, which have dealt with the question of nitrogenous equilibrium, that the amount of proteid, which can be absorbed from the large bowel, even under favourable conditions, falls far short of the minimum requirement of the organism, and that rectal feeding always entails a greater or less disintegration of the proteid tissues of the body.

Fats.—Very little difference of opinion has been expressed until recently as to the value of fats in rectal feeding. The majority are agreed that fats are badly absorbed from the large bowel, while Edsall and Miller have even suggested that, by their bacterial decomposition, they may be actually harmful. Munk and Rosenstein, in a case of fistula of the thoracic duct, found that fat injected into the large intestine was followed by an increase in the amount of fat in the chyle, indicative of an absorption of from 3·7 per cent. to 5·5 per cent. Strauss found that only 10 per cent. of fat was absorbed. Aldor, in one case, using the same enema throughout, found, on one occasion, that 33 per cent. of milk fat was absorbed, on another less than 1·5 per cent. Deucher, from extensive observations on three patients, concluded that 10 grammes of fat per day are absorbed with difficulty even in favourable circumstances, and that the best results are to be obtained by using it in small quantities with the addition of salt, and allowing it to remain in the bowel for a long period. Hamburger, on the other hand, from experiments on animals, concluded that fat was quite as readily absorbed from the large intestine as from the small, provided that it is administered in a proper emulsion, a solution of soap (sapo medicalis) being best adapted for the purposes of emulsifying the fat. This method has, as yet, not been investigated in the human subject. Edsall and Miller, using the natural emulsions of milk and yolk of egg, found the fat absorption in their two cases to be 13·61 per cent., or 6·48 grammes per day, and 33·46 per cent., or 15·87 grammes per day respectively. Boyd and Robertson obtained a fat absorption varying from 3·47 to 45·85 grammes per day. They found a definite relation between the amount of fat given and the amount absorbed, considerable fat absorption following the administration of a large amount of fat in the enema, although different individuals appeared to manifest diverse powers of absorption. Their results also indicated that the absorption of fat acted as a saver of proteid, the loss of tissue nitrogen being greater where the absorption of fat was poor. They conclude that emulsified fat, as yolk of egg, is a useful food-stuff in rectal feeding, and is much better absorbed than is generally believed.

Carbohydrates.—The general opinion, recently reaffirmed by Boyd and Robertson, is that sugars are quickly and freely absorbed from the large bowel, and it has been held that starches also are slowly transformed into sugars, and in large part absorbed. Strauss states that he has maintained patients in good condition for 1, 2, or nearly 3 months with enemata composed very largely of sugar. He claims that 40 or 50 grammes of glucose can be used in an enema in 10 per cent. to 20 per cent. concentration, and this continued for a month without producing, in the majority of cases, any irritation, and that any sourness of the stools can be corrected by the addition of thymol, or menthol, ¼—½ per 1000, to the enema. Deucher administered 200 grammes of sugar in 5 consecutive enemata, and determined the absorption to be 77 per cent., or 154 grammes in 19 hours. Zehmisch, administering 152 grammes, got an absorption of 103 grammes. Reach, on the other hand, believing that much of the sugar, which disappears from the bowel, is decomposed by bacterial action and not absorbed, investigated the question by administering various sugars by the mouth, and, at other times, the same amounts and kinds by the rectum, and determining their effect on the respiratory quotient. He noted the usual increase in the respiratory quotient when the carbohydrates were given by the mouth. When administered per rectum he found little or no influence upon the respiratory quotient. He accordingly concludes that the amount of sugar absorbed by the bowel is very considerably behind the amount absorbed when given by the mouth. Dextrine, he finds, is better absorbed than sugar, and, at the same time, does not irritate the bowel to the same extent. Boyd and Robertson, finding that less than 1 per cent. of glucose is destroyed by bacterial action when solutions of this sugar are inoculated with the bac. coli comm. or with bowel contents, and incubated for 4 hours at 37° C., conclude that bacterial decomposition of sugar in the intestine is not an important factor, and that the bulk of the sugar which disappears from the bowel does so by absorption. Using pure glucose, they found in all cases that it was well absorbed, from 89 per cent. to 100 per cent., and, although the absorption varies in different cases, this depends not on the amount administered, but on the varying capacity of the individual for absorption. In no case was there any irritation of the bowel produced by the glucose, and in none did alimentary glycosuria result. Sharkey, injecting 34·36 grammes of anhydrous glucose, got an absorption of 78·2 per cent., or 26·9 grammes. Most authors lay stress on the importance of using pure glucose, the commercial variety, as it is liable to contain such impurities as arsenic and traces of sulphuric acid, being apt to produce irritation of the bowel.

From the evidence available, it is difficult to come to any certain conclusion as to the value of such carbohydrates as glucose in rectal feeding. The method of those investigations, which indicate that glucose is well absorbed, is not above suspicion, and further work is needed before the significance of the results, obtained by the more crucial method of Reach, can be denied. Still, pure glucose in 10 per cent. concentration, may be employed as a constituent, until further investigation has proved it to be useless.

Salts.—It is generally believed that soluble mineral salts are well absorbed from the large bowel, provided that they are not of such a kind, or in such concentration, as to cause irritation of the bowel. Further, NaCl in concentrations up to 1 per cent. are held by many to facilitate the absorption of proteids in particular, and also of fats and carbohydrates.

In explanation of this, it was believed, on the basis of the experiments of Grutzner, Dauber, and Schweizinski, that sodium chloride induced antiperistalsis in the large bowel, and carried the enema back to the ileo-cæcal valve, and at times it might be with such force as to drive some of the material through into the small intestine. The investigations of Cannon, and of Elliott and Smith, however, have shown that antiperistalsis is a normal process in the transverse and ascending colon, and in the cæcum ; waves of contraction, occurring periodically, every 15 minutes, and lasting for about five minutes, churn up the contents of the colon, carrying them back towards the cæcum, and thus bringing them again and again into contact with the absorbing surface. The ileo-cæcal valve, as shown by Elliott, is not merely a mechanical valve, but a true muscular sphincter innervated by the sympathetic, and, by contraction, shutting off the cæcum from the ileum. Under certain conditions, it is conceivable that, owing to inhibition of the sphincter, the colon contents may be regurgitated into the small intestine, and such must be the explanation of the curious phenomena of vomiting of enemata, and the "buccal defæcation" of Jaccoud, and such may be the explanation of those cases, in which rectal feeding has apparently maintained the condition of nutrition of the individual.

Alcohol is another frequent constituent of nutrient enemata. It is well absorbed in solutions of 0·5 per cent. to 2 per cent., and by some it is held to facilitate the absorption of such substances as glucose and proteids.

Conclusion.—It would thus appear to be established that it is possible by rectal feeding to introduce a certain amount of food into the organism ; but, even accepting the more favourable results of recent investigations, the conclusion is inevitable that rectal feeding amounts, at best, to a pronounced subnutrition, that, only in exceptional cases, in which the metabolic processes have been gradually reduced to an abnormally low level, is it possible to provide an amount of proteid as will establish nitrogenous equilibrium, and so prevent disintegration of the proteid tissues of the body or of food-stuffs, having a total energy value beyond one quarter of that dissipated by the organism.

In the average case, rectal feeding is associated with progressive loss of weight, and at times the subnutrition may proceed to such a degree as to induce a condition of acid intoxication which, as pointed out by Rolleston and Tebbs, is particularly liable to occur in females.

It cannot therefore be relied upon to bring about a condition of improved nutrition, as is frequently desired by the surgeon before undertaking operative interference. In gastric cases, in which absolute functional rest is indicated as a therapeutic measure, it is doubtful whether such is attained by rectal feeding. According to Winternitz, rectal feeding is associated with a secretion of gastric juice. Metzger, on the other hand, found that enemata of plain water did not induce a secretion of gastric juice, that enemata of eggs, milk, and NaCl were similarly without action on the stomach, but that alcohol induced a considerable secretion. More recently, Umber has demonstrated on a patient, on whom gastrotomy had been performed, that the injection of food per rectum was followed by the secretion of gastric juice having a total acidity of 30, and free HCl of 20.

Recognising, then, the present limitations of the method, it would appear that the best of these results are to be obtained by the use of enemata composed of predigested proteids, of albumoses, or peptones, the two latter in 10 per cent. concentration, of emulsified fat, in the form of milk or yolk of egg, and of glucose in 10 per cent. concentration, with the addition of NaCl to 1 per cent.

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NOTES OF SURGICAL CASES.

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GASTRO-ENTEROSTOMIES.

Ten cases have recently been under observation, all of which were operated upon posteriorly without a loop, and the results, with one exception, were satisfactory. Details of this case, in which symptoms of delayed chloroform poisoning showed themselves, have already been recorded in the *British Medical Journal.* In the other nine, the operation was performed for pyloric stenosis, and in one, for a large pyloric tumour in a patient sent by Professor Stockman. Since the operation the tumour has diminished, and the patient has gained a stone in weight.

The Fowler, or elevated position, has been adopted with distinct benefit, feeding is begun twelve hours after operation, and sickness has not been troublesome.

Gastro-enterostomy for Ulcer of the Stomach, with Recurrence of Hæmorrhage and Death.—In the great majority of cases, gastro-enterostomy heals the ulcer, or ulcers, and stops the bleeding, but in a patient, sent by the late Dr. Finlayson, all went well until the fifth day, when an attack of profuse hæmorrhage from the stomach supervened, and death occurred on the sixth day. Fortunately a post-mortem was obtained, and a bleeding ulcer was found in the cardiac end of the stomach. As this is exceptional, it seems right to record the case.

CASES OF RUPTURED GASTRIC ULCER.

I. A. B., female, aged 27, was sent with history of indigestion, and symptoms of rupture. Operation showed small ruptured ulcer 2 inches from the pylorus, without extravasation. Ulcer stitched. Recovery.

II. C. D., female, aged 22, sent by Dr. Adamson with symptoms of rupture. Operation showed small anterior ruptured ulcer with large amount of extravasation. Ulcer stitched, Douglas's space opened, and drainage tube inserted, as also a large drainage tube in each flank, which was retained for 48 hours. This case was washed out with hot saline solution. Recovery.

III. H. D., female, aged 35, sent by Professor Stockman and Dr. Adamson. A large anterior ulcer was found ruptured and indurated. It was cut out with an oval incision, and the wound in the stomach closed by a double layer of stitches. Drainage in Douglas's space, loin drainage not required. Patient was kept sitting up as much as possible during convalescence. Recovery.

IV. R. C., female, aged 30. Small ruptured ulcer near pylorus. Ulcer stitched, drainage in Douglas's space. Recovery.

V. W. M., male, aged 27, with all the symptoms of ruptured ulcer. Exploration, no rupture found. Recovery.

Note.—It is well to remember that biliary colic, gangrenous gall-bladder, and diaphragmatic pleurisy produce urgent symptoms simulating ruptured gastric ulcer. Two cases illustrated this some time ago, one was seen with Dr. Somerville, the other with Dr. MacFayden, of Stirling. Both turned out to be diaphragmatic pleurisy, were not operated on, and got quite well.

GASTROSTOMY, KADER'S METHOD.

Since the record, in the *Lancet* of July 16, 1904, of four cases of gastrostomy done by Kader's method, several others have been operated on, and, having found the method extremely efficient, I have pleasure in strongly recommending it.

INTESTINAL OBSTRUCTION.

I. By a band. An urgent case, sent by Dr. Duff, Wishaw, had had several slight attacks. On opening the abdomen, a band was found tightly obstructing the ileum. This was divided, and the patient made a good recovery.

II. D. B., male, aged 24, was sent with acute obstructive symptoms, which had lasted for thirty-six hours. Operation showed a hernia into a peritoneal pouch by the side of a gland in the upper abdomen, the bowel being tightly held at the opening. On division of the stricture, the hernia was reduced, the peritoneal pouch disappeared, and the patient recovered.

III. A girl, aged 10, sent by Professor Stockman and Dr. MacPherson, of Bothwell, had been operated on for pyloric adhesions causing dilatation of the stomach. She had recovered from this, but was seized one evening with acute obstruction, and seemed *in extremis*. Ether was given, and the abdomen opened. A large hernia into the duodeno-jejunal pouch was discovered, and reduced. Recovery. Recovery in such cases is uncommon.

IV. A. P., female, aged 21, sent by Dr. Alexander, ot Galston, with acute symptoms. Operation showed a twist of the bowel with adhesions. This confirmed Dr. Alexander's impression, and no other obstruction could be found. The urgent symptoms were relieved, but recurred, and, on re-opening the abdomen, a stricture was discovered in the lower sigmoid embedded in adhesions. This was removed with difficulty, and everything went well until the fourth day, when sudden pain occurred, and the patient died in a few hours. The post-mortem showed, as I expected, that the bowel had given way. This case was particularly distressing to me as, had I found the contraction at the first operation, the chances of success would, of course, have been much greater, but the case is also instructive, as showing the great importance of a careful search being made for the possibility of more than one cause for the obstruction.

CASES OF APPENDICITIS.

On reviewing the results of operations on cases of appendicitis of all kinds, it is gratifying to notice a very great decrease of mortality, and that is accounted for, partly by the fact that medical men do not allow patients to remain long without surgical aid; we therefore get fewer cases of general peritonitis, and partly because surgeons are now content with opening the abdomen, evacuating the pus, and avoiding flushing-out the cavity. In burst appendix, very often the severity of the pain is enough to make the medical man anxious, and, before serious damage is produced, the appendix is removed. In catarrhal cases, the appendix is removed in young people during or after the first attack, unless there are any indications against interference.

Our last sixty cases, which included catarrhal appendicitis, with and without local abscesses and general peritonitis, all recovered except one of general peritonitis.

CHOLECYSTOTOMY.

Several cases requiring this operation have recently been dealt with, and, in these, we have adopted the method of Mayo Robson of draining the gall-bladder into a bottle which lies beside the patient. This saves soiling the dressings, adds to the patient's comfort, and diminishes the labour of the nursing. An ordinary drainage tube is fastened into the gall-bladder by a purse-string suture of chromic gut, the gall-bladder being attached to the aponeurosis. Generally ten days of drainage are sufficient.

ECTOPIC GESTATION.

Three cases of this nature have been recently treated, with considerable hæmorrhage, but, owing to excellent nursing, they recovered. All were tubal ruptures.

PROSTATECTOMY.

Eight cases have been recently operated on by the supra-pubic route. Seven recovered, and presented no unusual symptoms, the eighth was 82 years of age, although he looked more like 70; but, as he was suffering so intensely, after consultation with Professor Stockman and his own friends, we recommended operation, to which he gladly assented. A prostate, weighing 7 ounces, and 27 stones were removed. He did well for a week and seemed greatly relieved, but died somewhat suddenly.

ANÆSTHESIA.

In nearly all the cases, referred to above, my son, Dr. J. W. Renton, has given ethyl chloride followed by A.C.E. mixture with Silk's inhaler, or ethyl chloride followed by ether. We have been greatly pleased with the results. Sickness is slight, shock is much less, and urgent depressed cases are helped, whereas, had chloroform alone been used, they would not have been so well. I am satisfied that cases have been lost by the depression produced by chloroform. I can with confidence recommend ether in all urgent abdominal conditions, operations for removal of the prostate, hæmorrhoids, and in excision of the rectum.

SOME UNUSUAL ABDOMINAL CASES.

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The aphorism of Hippocrates that "experience is fallacious and judgment difficult" is as true now as it was in the days of its author, and applies, perhaps with more than usual significance, to the diagnosis and treatment of certain abdominal conditions.

The following four cases, for which I am indebted to the staff of the Salisbury Infirmary, came under my personal observation nearly two years ago, and, apart from their interest, they have been a liberal education in proving the necessity of the minutest attention to details in the paths of science.

Case I.—Tubercular peritonitis simulating intussusception.—R. D., male, aged 13 months, was admitted with two days' history of vomiting, abdominal pain, and constipation, with the passage of blood and mucus. The doctor, who had been treating the child, had used "water injections," and reported there had been "distinct improvement" on the second day, when a quantity of "*foul pus*" had been passed. On admission, the child had a temperature of 99°, pulse 132, respirations 32. He looked ill, but the facial aspect did not suggest the collapse so usually associated with intussusception. The heart and lungs were normal. The abdomen was moderately distended, moved well on respiration, was resonant all over, and was not tender. There was no visible peristalsis, and no tumour to be felt. The rectum was quite empty, as far as the finger could reach, and was ballooned. Having regard to the history, the abdomen was opened in the middle line below the umbilicus.

The condition found was as follows:—There was a moderate quantity of serous fluid free in the peritoneal sac, the mesenteric glands were much enlarged and firm; the terminal 8 or 9 inches of the ileum were injected, red, and distended, and showed numerous small sub-peritoneal petechiæ.

The peritoneal lining of the bowel was red and swollen, but had not lost its polish, and there was no thrombosis of the mesenteric vessels. The appearance was typical of that of a strangulated hernia within the first few hours. In the wall of the bowel, could be seen and felt an oblong swelling occupying about one half the circumference of the bowel, and about 1 inch × ½ inch in extent, no doubt a tuberculous ulcer. Within 2 inches of the ileo-cæcal valve was a narrow peritoneal band crossing from the anterior surface of the cæcum to the ileum, beneath which the ileum was partially occluded. This was divided, and the wound sewn up. The child made an uninterrupted recovery, on two occasions passing small quantities of blood per rectum.

This case, somewhat hastily assumed to be subacute intussusception, was plainly due entirely to tubercular peritonitis, and two pathological conditions—the ulcer in the bowel wall, and the abnormal peritoneal band—in combination produced the clinical picture of a partial intestinal obstruction together with the passage of pus per rectum. The latter symptom was certainly a puzzling feature, and, together with the absence of collapse of the child, should have made one hesitate before concluding the diagnosis of intussception. In infants the large majority of urgent abdominal symptoms, which come under the surgeon's care, depend upon the presence of an intussusception, and it is, therefore, essentially the first condition to be considered. Treves (*System of Surgery*) mentions that he has known three cases of chronic intussusception in children mistaken for tuberculous peritonitis, and no doubt the reverse is often the case. One learns, by painful experience, that almost any abdominal condition may be mimicked by this protean disease.

Case II.—Tubercular peritonitis simulating (coincident with ?) extra-uterine fœtation.—Mrs. C., ætat. 27, married one year ago, nulliparous, was lifting a chair, on Christmas Day 1905, when she suddenly felt "something give way" in the lower abdomen, together with sudden severe pain, which made her feel very sick and faint. She went to bed for a day or two, but did not see a doctor, and, a day or two later, felt fairly well, and resumed her household duties, but found herself unable to do much owing to constant pretty severe pelvic pain of a dragging nature. Her menstrual periods had always been regular, and the last one had ceased 14 days before the accident. A week later, menstruation recurred (*i.e.*, at the usual interval), lasted three days longer than usual, and was very profuse, consisting largely of clot. She was not noticed to have become suddenly anæmic. The pain continuing, she consulted a doctor, who found some tenderness in the lower abdomen, and a "firm and tender" swelling in the posterior and lateral vaginal fornices.

On admission some three weeks later, the patient, a delicate-looking woman of good colour, but somewhat chlorotic, had a temperature which varied from 98° to 100° F. The pulse was 80, the tongue moist and slightly coated. She complained of hypogastric pain upon micturition or pressure, and pain in the back and sacrum upon movement, and especially upon defæcation. The abdomen was resonant all over, tumid, and slightly distended, very tender upon pressure just above the pubes, but no lumps could be detected. The heart and lungs appeared to be normal.

By the vagina, the nulliparous cervix uteri was felt in the axis of the canal, it was fixed and tender. The posterior and lateral fornices were fixed and indurated, but not depressed. There was a rounded swelling, bulging the rectum, about the apparent size of an orange, but its upper and lateral limits could not be reached owing to the pain caused by rectal examination. Bimanually, the body of the uterus could not be felt in front, or separated from the mass behind. The uterine sound was not used. Vaginal examination was very painful, and, on that account, not very satisfactory. The condition was thought to be a small quiescent hæmatocele, following a very early extra-uterine pregnancy, and the patient was kept in bed upon a light diet, and closely watched.

A fortnight later, some evening rises of temperature having occurred, an anæsthetic was administered. No tumour could be detected in the abdomen. By the vagina, the condition appeared to be unaltered, but the body of the uterus could be felt midway between anteversion and retroversion ; it was fixed and apparently connected with the mass behind. It did not appear, so far as could be made out, to be altered in size or shape, but again the sound was not passed.

Per rectum, a small ragged hole could be felt in the anterior rectal wall, and a finger, pushed through this, found itself in the rounded swelling in Douglas' pouch, which was found to be a nearly circular thick-walled swelling, in the centre of which was a small cavity filled with old and fresh blood clot, and flakes of fibrinous material. There was no trace of embryonic structures. The cavity was gently irrigated, and drained with gauze. A few days later, the gauze was removed, and the patient was apparently doing very well, with the pain gone and the temperature normal.

Ten days later, however, she developed considerable evening rises of temperature, pain and marked abdominal distension. The abdomen was opened between the umbilicus and pubes, and a small quantity of ascitic fluid escaped. The bowel wall and parietal peritoneum were dotted with numerous young miliary tubercles, and the intestinal coils so matted to each other and to the omentum, that it was quite impossible, without the separation of these extensive adhesions, to explore the condition of the pelvis, either by touch or sight. The intestinal coils formed an apparently impenetrable roof over the uterus and annexa, but it was possible to obtain, deep down in the pelvis, a sense of an obscure cystic swelling, and a sense of fluctuation between this swelling and a finger in the posterior vaginal fornix.

The abdomen was, therefore, closed, and an intra-peritoneal opening made in the posterior fornix, when a large quantity of serous fluid immediately escaped under high pressure. This discharged freely for several days and then ceased. Its cessation was followed by pain, distension, and temperature, and the patient's condition became a matter of great anxiety, but all was suddenly relieved by a further large escape of fluid. Thenceforward, no untoward symptoms occurred. She gained flesh, the temperature became normal, and she was discharged apparently cured, certainly as well as she may ever be expected to be.

The interest of this case lies in the difficulty of determining the exact pathological condition; whether tuberculous peritonitis was co-existent in an individual with an early ruptured gestation-sac, or whether the whole condition depended solely upon a pelvic tuberculosis, in which case one must presume that a sudden effort ruptured a very vascular adhesion, or caused hæmorrhage into a diseased Fallopian tube. It is well known that the pelvic organs in women are responsible, in far more cases than was at one time thought possible, for the origin of not only a pelvic, but also a more generalised tuberculosis. In this particular case I do not think that, on the evidence, it is possible to be dogmatic one way or the other.

Case III.—Cirrhosis of liver (with Riedel's lobe) simulating acute cholecystitis.—Mrs. P., ætat. 29, had been under treatment some months for alcoholism and cirrhosis of the liver. There had been no history of gall-stone colic, but, for some time, there had been chronic pain in the right hypochondrium of a dragging, tearing nature, and a moderate degree of jaundice, without ascites. The day before admission she had become suddenly and alarmingly worse, with very profound jaundice, increased pain, vomiting, and some abdominal distension, together with a quick compressible pulse and high temperature. She was sent in on a diagnosis of "gangrenous cholecystitis."

On admission she was obviously very ill indeed. The pulse was thin and wiry, over 130 to the minute, the tongue dry and furred, the temperature 102° F., and the hands tremulous. There was a profound jaundice of skin and conjunctivæ. The thoracic viscera were healthy, with the exception of some bronchitis.

The abdomen was somewhat distended, but moved well on respiration. There was marked tenderness in the epigastrium and right hypochondrium, where a large, firm, smooth liver could be felt, extending 3 inches below the right costal margin. In the right hypochondrium, below and continuous with the liver, was a roughly oval swelling, reaching down as far as the umbilicus. It was firm, smooth, of the consistence of liver, and moved freely on respiration. Except over the liver surface, the abdomen was resonant, and the tenderness was not so exquisite as to suggest any peritoneal infection. In spite of the history and physical signs, the surgeon in charge preferred to explore, when the supposed gall-bladder proved to be, as had been suggested, that not uncommon anomaly, a Riedel's lobe. The gall-bladder and peritoneum were healthy in every way. The wound was closed, and the patient returned to bed. She died suddenly on the following day, and an autopsy was not obtained. The dictum of modern surgery, "if in doubt, look and see," is sound enough up to a certain point, and especially so in abdominal work, in which it is infinitely safer to explore a doubtful condition than to leave it alone, but there should be a reasonable doubt as to the diagnosis before such exploration is undertaken. It is a well-established fact that the terminal stages of an hypertrophic cirrhosis are commonly associated with high fever, deep jaundice, and even delirium, as well as vomiting, abdominal distension, and pain. In differentiating such a case from an acute cholecystitis, necessitating surgical interference, the utmost importance should be given to the condition of the peritoneum, as evidenced by the nature of the abdominal distension, rigidity, and pain, all of which may or may not be present in varying degree. In this particular case it is doubtful if the evidence was quite strong enough to justify a diagnosis of cholecystitis, especially when the physical signs of the supposed gall-bladder were so strongly suggestive of those of an abnormal lobe. The exploration did no harm, and was completed in twenty minutes, and, though to be regretted from a strictly scientific point of view, it was, in the circumstances, the safest thing to do, and in the best interests of the patient. For it must be remembered that there is no human being who can, with absolute certainty, diagnose the implication or otherwise of the all-important peritoneum.

Case IV.—Torsion of Kidney, simulating Appendicitis.—E. D., female, unmarried, æt. 34, a domestic servant, while travelling one afternoon from Stroud to Salisbury to take up a new situation, was seized in the train with violent pain in the right iliac fossa, with vomiting. She managed to continue her journey in great pain, which continued all night, and, on the following day, she was admitted to the infirmary. On admission, she stated that she had never had a similar attack. Menstruation had always been regular and painless, and she was not menstruating at the time. Her temperature was normal, pulse 82, the tongue furred but moist. The respiration rate was quickened. She looked anxious, but not acutely ill, and complained of severe right-sided abdominal pain. The heart and lungs were healthy. The abdomen moved well, but jerkily, on respiration. It was full, but especially so on the right side, and the lower half of the right rectus could be seen to be contracted, and arched up in a most striking fashion. On palpation, this muscle was held as rigid as a board, and to a less degree upon the other side. On deep palpation, which the rigidity made a difficult task, an indefinite tender swelling could be made out deep to the muscles, in the right iliac fossa, and in the right loin, and it was thought that a doubtful sense of fluctuation could be made out from front to back, about which, however, it was quite impossible to be certain. Percussion did not reveal any dulness over the swelling; there was a well-defined interval between the costal margin and the upper limit of the swelling.

The patient, after consultation, was advised an operation, and was prepared in the usual way. *A catheter was passed*, and a few ounces of normal urine drawn off. Under the anæsthetic, the swelling was more easily felt, but appeared to be considerably smaller than had been supposed, although still cystic in character; but, at this stage, the anæsthetic had not been sufficiently pushed to secure total muscular relaxation. A few minutes later, the abdomen was opened by displacement of the right rectus inwards. No tumour of any sort or description was found in the iliac fossa. The appendix, uterus, ovaries, and Fallopian tubes were all healthy, but the bladder was distended, although a catheter had been passed just before operation. A catheter was again passed, and 8 ozs. of urine drawn off. Attention was now directed to the right kidney, which was now found to be freely "floating," and which was quite capable of being brought down to the brim of the pelvis. It now became pretty evident that the symptoms were due to a temporary hydronephrosis in a movable kidney, while the kidney was in the right iliac fossa, which had spontaneously evacuated itself into the bladder during anæsthesia. It was probably due to a partial kink in the ureter—no stone could be felt in the ureter or bladder—and it seems probable that the examination of the swelling, under the anæsthetic, had led to movement of the kidney, and straightening of the kink.

The wound was closed, and the patient returned to bed. The after history was satisfactory, and although, upon the ninth day, the patient had a mild, somewhat similar attack, with tenderness and deep resistance in the right iliac fossa, no relation could be established between the attack and the amount of urine passed, although the latter was carefully measured for a fortnight after the operation.

She was discharged to a convalescent home, the question of having nephropexy done for her, on her return, being under consideration. At first sight this case appeared to be very like appendicitis—the pain, the vomiting, the patient's age, the rigid abdomen, were all suggestive. On the other hand, the normal temperature, the pulse of 82, the appearance of the patient, together with the presence of a swelling of such dimensions in the first 24 hours of the attack, were very strong points against such a diagnosis. It is safe to say that a swelling of that size, in the first 24 hours of appendicitis, means widespread peritoneal infection. The feel suggested fluid. Surely it is uncommon, in such a short time, to have a purulent collection with practically no general symptoms, when one would certainly look for a high temperature, rapid pulse, and other symptoms of a virulent infection. On the other hand, a slow pulse is not necessarily an argument against a peritoneal infection. I have seen a perforated gastric ulcer, with a pulse of only 80, and no opium had been administered.

No diagnosis had been made in this case before operation, as that of appendicitis, tempting though it was, as a way out of difficulty, was not sufficiently justifiable.

"WEAK HEARTS" IN GENERAL PRACTICE.

By GORDON LAMBERT, M.D.

THE general practitioner is frequently called upon to treat patients, who have been told by former medical attendants, or have decided for themselves, that they suffer from "weakness" of the heart. In a large proportion of such cases there is considerable truth in the statement, but both time and patience are often needed for forming an accurate opinion as to the nature and cause of the heart's weakness. The difficulties presented are not slight, and too often the task of arriving at a definite decision, the only possible guide to rational treatment, is abandoned at the very outset.

It is an undoubted fact that our present methods of physical examination enable us to diagnose, with certainty, only comparatively gross lesions of the heart. Certain less gross, though not less important lesions, cannot be distinguished from one another, nor even, in many cases, detected. For example, the diagnosis of fatty and of fibroid degeneration of the heart is almost invariably attended with doubt and uncertainty. To distinguish between these two conditions, by clinical signs and symptoms, is an extremely difficult (if not impossible) matter. Again, there are no characteristic signs or symptoms, on which we may base a positive diagnosis of impairment of functional activity of the cardiac muscle cells, to the exclusion of grave degenerative changes; we may diagnose impairment of power, but we cannot exclude degeneration.

A knowledge of certain cardinal facts, relating to the structure and action of the heart in health and disease, should enable us to lessen these difficulties, though we cannot entirely remove them, and to classify the cases of heart weakness met with in everyday practice. Unfortunately, it is not possible to find a basis for a perfect logical division of these cases, and cross division is, therefore, inevitable. It is an accepted fact, however, that in all weak hearts one or more of the following factors contribute to produce morbid effects :—

1. Morbid conditions of the cardiac muscle cells—impaired functional activity, degeneration.

2. Deficiency in quality or quantity of the general blood-stream.

3. Degenerative changes in the arterial system, particularly in the aorta and coronary arteries (causing ischæmia of the myocardium).

4. Derangement of nervous control by the cardiac centre and nerves.

It is obvious that, in some cases, all these factors may come into operation, but, in most cases, one factor is more potent than the others. An attempt to decide which factor predominates in any case involves many considerations, the age, previous history (especially as regards infectious febrile diseases), habits, and mode of life of patient (with particular reference to alcohol, tobacco, lead, etc.) in addition to the physical signs revealed by careful examination of the heart and arteries.

The most profitable classification may, perhaps, be made on an ætiological basis, coupled with constant remembrance of the four factors above enumerated. Weak hearts may then be considered under the following heads :—

1. *The Anæmic.*—This group comprises those hearts whose disability is due to abnormal conditions of the general blood-stream, and consequently to disturbed nutrition of the myocardium. The blood may be deficient either in quality or quantity. Its defect may consist in a variety of morbid conditions of its corpuscles (numerical deficiency or excess, intrinsic changes), in reduced percentage of hæmoglobin, in diminished total bulk, in the presence of abnormal constituents (organic or inorganic toxic bodies as in syphilis, chronic lead poisoning, etc.). The forms of primary anæmia, pernicious anæmia, leucocythæmia, chlorosis, are prominent members of this group. Numerous are cases in which secondary anæmia is due to metrorrhagia, hæmatemesis, or to long-continued suppuration, or to Bright's disease, or to the cachexia induced by malignant tumours.

Examination of the blood shows that all these forms of anæmia have one feature in common, though they differ considerably in other respects, viz., that the hæmoglobin is diminished, and consequently the supply of oxygen falls short of the demands of normal metabolism. The myocardium suffers with the other tissues, the metabolism of its cells is not perfected, and they are prone to undergo fatty degeneration. Even if fatty degeneration is slight or absent, the working capacity of the heart is diminished, owing to impaired functional activity of its muscle cells. The tonicity of the heart depends upon perfection of the metabolism of its muscular fibres, not upon the vagus nerve, as Von Bezold believed. Its contractile power and rhythm of action are inherent properties of the incompletely differentiated protoplasm of which the myocardium consists. (One of the chief attributes of undifferentiated primordial protoplasm is the power of spontaneous movement.)

The weakness of anæmic hearts manifests itself by various signs and symptoms. Breathlessness is an early symptom. Of palpitation and præcordial distress complaint is constantly made. The heart's impulse is weak, and often diffuse, except after exertion, when the impulse may become forcible. At rest, the pulse is often regular though feeble, but, after exertion, it becomes frequent and irregular. The rate is accelerated, because the imperfectly oxygenated blood has to be sent through the heart and other muscles oftener per minute than healthy blood, the augmentor nerve is, therefore, called into action. The irregularity is ascribed to failure of the depressor mechanism (vagus) to slow down the labouring ventricle, which acts, therefore, with a rhythm independent of that of the auricle, on which the inhibitory influence is more effective.

It is manifest that these enfeebled, anæmic hearts are liable to become dilated. Not only, therefore, are hæmic murmurs heard at the base, or over the jugular veins, murmurs due to physical conditions imperfectly understood, but a systolic murmur may be heard at the apex, due to regurgitation from the left ventricle. The murmur is conducted outwards, the pulmonary second sound is accentuated, and dulness to the right of sternum may be increased.

Of the effects of imperfectly oxygenated and vitiated blood on the heart, Dr. G. W. Balfour quotes a striking instance.

The case was that of a man, aged 36 years, who was "organically sound, yet his life made useless and miserable by a heart feeble, intermitting, and irregular." Balfour ascertained that he worked in a badly ventilated office, in which a good deal of gas was burned. Improved ventilation and a tonic completely restored his health within a month.

2. *The Nervous or Neurotic.*—This is a large group comprising a multitude of diverse cases. It includes weakness of the heart produced by degeneration of the vagus, as in the toxic neuritis of diphtheria; by general functional disorder of the nervous system, as in neurasthenia and hysteria; by mental disturbance, worry, and anxiety, which induce cerebral inhibition; by reflex impulses to the cardiac centre from any organ which is diseased, stomach, intestines, lungs, kidneys, uterus, etc. When the wide distribution of the vagus is remembered, it is easy to understand how readily irritation of one of its numerous branches may be reflected along its cardiac fibres.

The control of the heart's action by the nervous system, though secondary, is important. No doubt the normal healthy heart is in great measure independent of this control, in the absence of unusual demands upon its strength, by virtue of its inherent property of spontaneous rhythmic movement. When, however, the working capacity of the heart is reduced, owing to abnormal states of its nutrition, occasions constantly arise for exercise of the conservative influence of cardio-inhibitory action. The weak heart is liable to become distended with blood, which it cannot expel by systole, it cannot overcome the peripheral resistance. An impulse then passes along the depressor fibres of the vagus to the vaso-motor centre, from which inhibition of vaso-constrictor fibres is effected. The heart's rate of action is simultaneously reduced. The work is thus brought down to the level of the heart's capacity, and cardiac failure is averted. The failure of this mechanism is the final incident in many fatal cases of diphtheritic paralysis of the heart, in which the myocardium suffers degeneration, and the depressor fibres fail to transmit impulses owing to degeneration (toxic neuritis).

Vagus inhibition, however, may be excited reflexly when it is not needed. A violent emotion, sad or joyful, may induce sudden fatal inhibition of the heart's action. Worry and anxiety may induce repeated stimulation of the vagus, and disease in any organ may produce the same effect.* Now, the result of this repeated stimulation of the vagus is repeated intermission of the heart's action. We know that even a normal healthy ventricle does not invariably discharge its full contents at each beat into the aorta ; but intra-cardiac pressure is kept within limits because the normal heart has the power of executing contractions, of which the force is proportioned to the degree of its distension. This is an example of the law that all healthy organs have a wide range of working capacity, a reserve of force-producing tissues : "latent tissue."[1] When, however, the heart's action becomes intermittent, that is, when heart beats are missed from time to time, blood accumulates in its chambers. In the young, vigorous heart no grave result may follow, for the heart succeeds in expelling the accumulation by more forcible systole ; but, in the old or enfeebled heart, progressive dilatation is the almost inevitable result. The law of Roy and Adami comes into operation in these, and all other, cases of dilatation of the heart. *The strain upon the walls of a sphere or spheroid increases with its circumference, and, therefore, the resistance to the contraction of the heart wall is increased whenever it becomes dilated.*

The consideration of the various types of arrhythmia of the heart's action is beyond the scope of this article. It must suffice to note that intermittence of action is usually accompanied by irregularity, and that there is often "order in rhythmical disorders, that is, short series of varying irregularities may regularly succeed each other" (Mitchell Bruce).

The symptoms, associated with disturbance of the heart's innervation, are legion. They vary from simple consciousness of the heart's action, with or without dread of impending death, to actual syncope. In this connection, it is worthy of note that the excessive use of tobacco is not infrequently responsible for alarming syncopal attacks. Tobacco first stimulates, and then paralyses the vagus nerve, of which it may induce acute or chronic poisoning, leading to actual dilatation of the heart, and even to death itself.

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* It should be noted that certain authorities maintain that afferent impulses from diseased organs (*e.g.*, the stomach—dyspepsia), *inhibit* vagus action, and that tachycardia results from unrestrained accelerator action (*vide* Lazarus-Barlow, *Manual of General Pathology*, 1898, p. 87).

3. *The Alcoholic.*—The abuse of alcohol produces morbid conditions of the heart with sufficient frequency to warrant separate grouping of alcoholic weak hearts. The signs and symptoms, presented by the alcoholic weak heart, differ less in character than in degree from those already described for the anæmic heart. This clinical resemblance of the two groups is readily explained by the fact that they have to some extent a common pathogenesis. In both groups the myocardium suffers impairment of functional activity owing to abnormal nutrition, which tends in both instances to produce fatty degeneration. Excessive ingestion of alcohol leads to widespread deposition of fat in the body, familiar to us as the obesity of alcoholics. Not only is the sub-cutaneous fat increased, but there is an increased deposit of epicardial fat. This fatty infiltration penetrates the heart substance, causing secondary degeneration of the muscular fibres by mechanical compression. It is probable, however, that the degeneration results in greater measure, from a more direct action of the alcohol upon the cardiac muscle cells, from its shielding of the protoplasm from oxidation, combined with the injurious effects of toxic impurities contained in it.* Moreover, the influence of alcohol in the production of atheroma and arterio-sclerosis must not be forgotten. The aorta and coronary arteries suffer early and with marked frequency.

The alcoholic has a "flabby" heart in a "flabby" body. The heart's impulse is diffuse and feeble, the apex beat is often displaced outwards, less by hypertrophy than by dilatation. The dilated right ventricle may thrust back the left ventricle and the impulse of the former may be mistaken for that of the latter. The first sound is not infrequently short and sharp, but both sounds are often heard indistinctly through the thick covering of the chest wall. Slight exertion is sufficient to cause dyspnœa, præcordial distress, intermittent and irregular action of the heart. More severe exertion, such as running to catch a train, may produce either fatal syncope, or permanent dilatation of the heart. Chronic alcoholics, however, are seldom energetic persons, and fatal syncope overcomes them more commonly during an attack of delirium tremens. Dr. F. W. Mott, in a paper published some years ago, and now, unfortunately, out of print, on "Cardio-vascular Nutrition in relation to Sudden Death," laid some stress on the part played by the musculi papillares in sudden failure of the alcoholic heart. The musculi papillares show the macroscopic and microscopic appearances of fatty degeneration, when the myocardium is the seat of that change. Their contractile power, therefore, is diminished, and they may fail to maintain closure of the valvular orifices by their pull on the valves, exerted through the chordæ tendineæ.

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* Both fatty infiltration and fatty degeneration, however, are present in the fatty hearts of those who suffer from the diathesis of obesity, though, in some cases, alcoholism plays no part.

4. *The Post-febrile.*—Under this heading are included cases in which weakness of the heart has arisen as a sequential effect of an acute specific febrile disease. The materies morbi of the specific infectious diseases induce in the myocardium, and other tissues, the parenchymatous, or granular, degeneration of Virchow, which is characterised by the presence of albuminous granules. Side by side with these albuminous granules, in an affected cell, may be seen larger fatty granules, and it is believed that granular degeneration is the first step towards fatty degeneration. One is disposed to regard the albuminous and fatty granules as the products, in part at least, of the exaggerated katabolism, which occurs in acute febrile diseases to enable the body to feed upon itself, the processes of digestion and assimilation being gravely impeded.

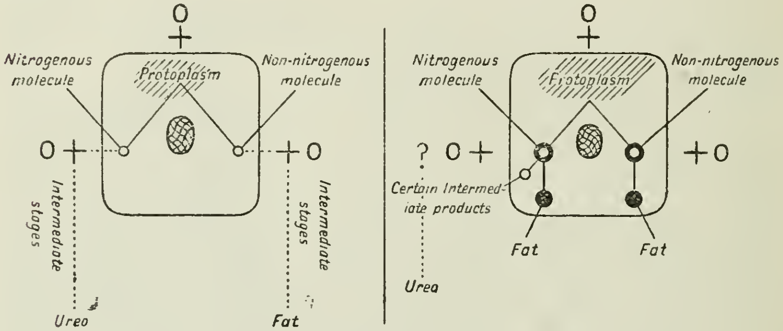

Fig. 1.

There is evidence that, in the metabolism of health, protoplasm splits up into a nitrogenous molecule, which is the first step in the formation of urea, and a non-nitrogenous molecule from which fat is formed. The urea and fat are formed outside the cell body by further oxidation. In acute febrile diseases, the molecules are formed in excess, and are not removed from the cell with the usual rapidity; the major parts of both molecules of disintegration remain within the cell, and are there converted into fat by degenerative changes (Fig. 1). Whether this hypothesis is approved, or rejected, the fact remains that, in a myocardium, affected by parenchymatous degeneration, which is always general, and not localised, large numbers of the muscle cells are destroyed. The dead tissue is doubtless replaced in the course of time, probably to a greater extent by replacement fibrosis than by regeneration. Recovery of many cells occurs; but it is questionable whether recovery is complete in all, or in even in most, of the affected cells which do not die. The writer's experience of the effects of acute febrile diseases on the heart has inclined him to believe that the disability induced in that organ is frequently permanent. These cases of permanently damaged hearts may be divided into two main groups:—

(*a*) It is not uncommon to meet patients, who complain of weakness of the heart, which began immediately after an attack of influenza, or some other acute febrile disease, often some years previously. Comparatively slight muscular exertion induces dyspnœa in these patients. On examination the heart's impulse is found to be weak or not palpable. The first sound closely resembles the second sound in both duration and character. Now, the cause of the heart's impulse is, we know, the hardening of the stationary portion of the left ventricle in contact with the chest wall, transmitted to the finger. The first sound consists of two component elements, a muscular and a valvular element; the second sound has a valvular element only. It follows that both the alteration of the first sound and the weakness of the impulse indicate impairment of muscular power of the myocardium. In these cases the small volume and low tension of the pulse afford confirmatory evidence of weakness of the myocardium. With our present methods, it is most difficult to diagnose the pathological changes underlying this impairment of power. It is obvious that recovery of the myocardium has been incomplete; its weakness may depend upon partial exhaustion of the inherited vital energy, and possibly atrophy, of its cells, which the blood supply has failed to recuperate, with or without fatty or fibrous changes following cell destruction.

(*b*) Less numerous are cases in which definite symptoms of cardiac failure have appeared during convalescence, and have recurred at intervals. Cardiac dyspnœa and oppression over the præcordium are complained of, the apex beat is displaced outwards, epigastric pulsation is present, percussion dulness to right of sternum is increased, an apical systolic murmur is audible and conducted outwards. Such are the clinical signs during an attack of cardiac failure. Improvement occurs under treatment, but the symptoms return from time to time. When an attack has subsided, it may be found that the heart is not hypertrophied; the apex beat may be well within the nipple line. The systolic murmur ceases, but the pulse seldom becomes regular. Evidence of arterio-sclerosis can often be detected, in spite of the absence of hypertrophy. It seems probable that, in these cases, parenchymatous has progressed to fatty degeneration of the myocardium. Possibly hyaline and other degenerative changes, induced at the same time in the arteries, have resulted in arterio-sclerosis, in the causation of which the specific infections may play a greater part than is at present known.[2] Undoubtedly degeneration in the coronary arteries would exert a potent influence for evil on a myocardium hovering between recovery from parenchymatous degeneration and retrogression to fatty degeneration.

Recent observers incline to the view that fatty degeneration is the initial, and fibrosis the common secondary, result of sclerosis of the coronary arteries. All agree that it is surprising to how great an extent the muscular tissue may be replaced by fibrous tissue without marked affections of the heart's action.

The writer has given elsewhere a brief summary of the immediate and remote effects of febrile diseases on the myocardium.[3]

5. *The Athletic* (*or Strained*).—This group includes cases in which strain of the heart has been caused by physical

exertion too severe, or too prolonged, for the strength of the individual. The best examples of this form of heart weakness occur in athletic school boys, and in young soldiers, in whom the "irritable heart" is induced by prolonged marches. In a paper published on the subject,[4] Dr. Arthur Lambert, of Harrow, presented the results of his observation of this affection in public school boys. He stated his belief that the progression from physiological to pathological dilatation of the heart is not gradual, that the transition is abrupt. "The boy is accustomed to extreme breathlessness, but when acute dilatation befalls him he recognises its onset as a sudden evil. He 'felt something give' or he 'became faint all at once,' or he 'felt a sudden pain in his chest and couldn't go on.'" This sudden onset is usually associated with increased frequency and irregularity, in rhythm and volume, of the pulse. The increased frequency and irregularity of the heart's action may persist for an indefinite period ; the disorder of action may permanently remain in some cases. The first sound of the heart, in many cases, is short, slapping and accentuated. Percussion dulness to the right of sternum is not infrequently increased and the pulmonary second sound accentuated. The face may be pallid and the lips blue.

In the paper referred to above, stress is laid on "the tendency of all these cases to recurrent dilatation of the heart, whatever may have been the method of their production." Premature return to active exercise is followed by recurrence, frequently with augmentation, of the symptoms. Chronic hypertrophy and dilatation are among the possible results enumerated. In the discussion of the pathology of heart strain, it is suggested that fibrous hyperphasia may play an important part in the later stages. This suggestion is founded on Dr. E. Colbeck's view that when an increased blood supply reaches a specialised tissue, the result is increased functional activity, or increased growth, but when, owing to protoplasmic insufficiency, the master tissue is unable to deal with and control the food supply, increased nutritive opportunities are afforded to the supporting fibrous tissue, which thereupon proliferates.[5] Its application to the heart is explained as follows :—"I venture to suggest that beneath the varied phenomena of heart strain lies over-taxation of the heart muscle to such a degree that it fails to respond to increased functional stimulus and nutritive supply,* a failure which implies protoplasmic inadequacy, and derangement of the inherent functions of the myocardium . . . at a later stage would follow that fibrous hyperplasia."

In an instructive article, recently published by an American physician, Dr. Woods Hutchinson, on "Exercise and its Dangers," occurs the following statement, "every physician who has practised in or near a university town can point to a dozen athletic young men, who have been seriously injured by muscular exercise. Particularly is this true of overstraining and hypertrophic disease of the heart muscle. A recent study, by the school physician, of the boys in training at a western academy showed that over sixty per cent. had cardiac murmurs." It is further pointed out that "the large heart of the athlete often contains inflammatory exudate; to put it roughly, is swollen from congestion. Second, that this large heart, whether normal or diseased, after the contest is over, and training is relaxed, begins to shrink again. This shrinking is brought about by a fatty degeneration and absorption of both the inflammatory exudate, and the surplus muscle-fibres, and, if it goes a step too far, may become one of our most insidious and dangerous cardiac diseases, fatty degeneration of the heart."

6. *The Senile.*—In considering the signs and symptoms associated with the effects of advanced age on the heart, it is important to remember the oft-repeated axiom that "a man is as old as his arteries." To this it may justly be added as a corollary, that a man's myocardium is as old as his arteries, more particularly, as the root of his aorta and his coronary arteries. Dr. G. W. Balfour considers it erroneous to believe that old age *per se* induces strictly morbid conditions of the heart.[6] He inveighs against the prevalent use of the term "senile decay"; in his opinion, involution is not less a physiological process than growth, and to attribute death to senile decay is to confound terminal events with disease. He emphasises his opinion, which is shared by others, that the heart does not undergo atrophy, but actually hypertrophies in normal old age. This hypertrophy is due to the fact that,

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* During active physical exertion, the myocardium is flushed with blood by the coronary arteries.

with advancing years, the arteries undergo changes, the chief result of which is diminished elasticity, and that the capillaries tend to dwindle and obsolesce, the cessation of growth and condensation of tissue abolishing the need for a large network of capillaries. The heart's work is thus increased in two ways "By the time the heart has succeeded in permanently dilating the inelastic arteries, and has restored them to their former relative magnitude, the increase of the peripheral resistance, due to the withering of the capillaries, is sufficient to prevent any material lowering of the blood pressure from this cause, *i.e.*, loss of arterial elasticity. By-and-by, however, this is gradually brought about by weakening of the heart through failure of the genesis of force, due to failure of assimilation, arising from withering of the capillaries in the skeletal muscles, as well as in all the glands of the body." Balfour goes still further. He maintains that the changes, which occur in the heart arteries and urine in old age, are precisely those described by Gull and Sutton in the pathology of arterio-capillary fibrosis and granular kidney. Moreover, he states his belief that the gouty diathesis is present in each one of us after middle life, when there is a slowly increasing tendency of the blood to accumulate in the veins, and to accumulation in consequence of serous plasma in the extra-vascular spaces.

Failure of the senile heart depends upon weakness of the myocardium. Whether we regard this weakness as the result of "senile decay," or of "failure in genesis of force, due to failure in oxidation and assimilation," or to "protoplasmic insufficiency," its results remain the same, gradual impairment of the power of executing regular, rhythmic, efficient contractions. This impairment of functional activity of the myocardium reveals itself by irregular and intermittent action, from which results dilatation of the heart (*vide antea*, p. 692). To these must be added tachycardia, bradycardia, delirium cordis, and sensory symptoms, palpitation, præcordial distress, giddiness. In its production, the increasing venosity of the blood, mentioned above, is no doubt an important factor, a vicious circle being established by interaction between the failing heart and its impure blood supply. Another important factor, in many cases, is the diminished blood supply by coronary arteries, which are the seat of degenerative changes.

Thrombosis in a coronary artery may occur, and lead to sudden fatal syncope, or sudden death may occur during an attack of angina pectoris. It is obvious *a priori* that violent emotional disturbance, worry, and anxiety, reflex inhibition from dyspepsia, etc., too severe physical exertion, or the strain of an acute febrile disease would exert a gravely deleterious or fatal influence on the senile heart.

These six groups include the most common varieties of the weak heart as met with in general practice. One cannot claim that they include all cases, nor can one deny that cross division occurs in this classification ; but that is inevitable under any method of grouping of weak hearts.

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SIR WILLIAM GULL, BART.

LEADERS IN MODERN MEDICINE.

III.

SIR WILLIAM GULL.

[With Plate XVII.]

> "Justum et tenacem propositi virum,
> Non civium ardor prava jubentium,
> Non vultus instantis tyranni
> Mente quatit solida."

"If I am anything, I am a clinical physician," said Gull of himself, on one occasion late in his life, a period when all thoughtful men, especially those with keen and powerful intellects, are quite cognisant of their real capacity and true value. In thus appraising himself, Gull certainly did not overestimate his position in medicine, for the tablet erected to his memory by the governors and staff of the hospital in the chapel at Guy's, records that, "as a teacher, few have exceeded him in the depth and accuracy of his knowledge, in the lucidity and terseness of his language, in the effect produced upon his hearers. As a physician, his almost instinctive insight, his unwearied patience, his exact method and ready resources, and, above all, that hearty sympathy, which seemed concentrated for the time on each patient, placed him in the highest rank in the noble band of British physicians."

Considering that Gull rose to this position of pre-eminence, from comparatively humble circumstances, by dint of force of intellect, assiduity, and exceptional power of work, as well as by the ever-tenacious grip with which he had seized upon opportunity, the story of his life is full of interest, particularly that part relating to the early growth and development of his remarkable powers. We obtain a vivid idea of what he was from the accounts of three writers, who approach this subject from different points of view. In the *Memoir*, written by Dr. T. D. Acland, Gull's son-in-law, and the son of his most intimate friend, in which "an attempt has been made to give a simple portraiture of Sir William's life and ways of acting in it," we have, aglow with affection, the richly-deserved and appropriate tribute of filial piety. In the *Guy's Hospital Reports*, Dr. Pye-Smith, himself not the least eminent among the brilliant group who learned medicine under Gull, bears witness to the intense pride and affection borne him by all who came under his spell as a teacher. Finally, in the *Biographical History of Guy's Hospital*, somewhat abridged from the original in the *British Medical Journal*, is the dispassionate and reasoned judgment of his junior contemporary and colleague, Sir Samuel Wilks, still, happily, with us, the loved and honoured Nestor of our profession, never, like Gull, a "physician in fashion," but more than his equal in all matters of knowledge and capacity. It is abundantly evident from all these that, "from whatever point of view Gull is regarded, he remains one of the foremost men of mark of his time."

William Withey Gull, youngest of a family of eight, was born at Colchester on the last day of the year 1816. His father, John Gull, was a barge-owner and wharfinger. Four years after William's birth the family removed to Thorpe-le-Soken, a secluded village near Walton-on-the-Naze, and part of the Essex property belonging to Thomas Guy's Foundation. John Gull died in London of cholera, in 1827, leaving his family in straitened circumstances, but his widow devoted herself entirely to bringing up her children. "She was," says Acland, "a person of remarkable character, and of clear, sound judgment; industrious, persevering, and possessed of great ability. . . She taught her children to be self-reliant, to do everything for themselves, and to do whatever they did well; for she would say, 'Whatever is worth doing is worth doing well.'" After outgrowing the dame's school in the village, Gull went to one kept by the clergyman of the parish. In looking back to his childhood, he would often say that his real education had been given him by his mother. To the end of his life he would often quote a little nursery rhyme, learned in infancy :—

"If I were a tailor, I'd make it my pride
The best of all tailors to be;
If I were a tinker, no tinker beside
Should mend an old kettle like me."

The moral of this little jingle was the ruling principle in Gull's whole life and career.

He had absorbed, in a few years, all the stock of knowledge the clergyman was able to impart, but fortunately the rector of the neighbouring parish of Beaumont, out of regard for the widowed mother, was willing and able to further the lad in his studies. In this connection, however, the point of greatest and most vital importance to Gull lay in the fact that the rector was nephew to Benjamin Harrison the younger, "King" Harrison, the beneficent despot, who, for over fifty years, reigned supreme as treasurer at Guy's, both in the hospital and in the school. He was the virtual founder of the latter, the idea originating with Astley Cooper. Exactly when and how the treasurer first became interested in William Gull is not very clear, but it seems certain that Harrison brought him to London in 1834, and sent him as an usher to Mr. Abbott's school in Grange Road, Bermondsey, and that while there he was frequently at Guy's visiting his patron, and attending lectures on chemistry and other elementary subjects. At the same time he was also teaching himself Greek and mathematics. Mr. Abbott took his school and scholars from Bermondsey to Lewes, and here Gull became acquainted with Joseph Woods, a botanist of note, with whom he used to tramp over the Downs, studying the fauna and flora of Sussex. Now came a craving to go to sea, and "he would in after years refer to the anxiety and distress he experienced at this period of his life, owing to the inadequate means at his disposal for satisfying the desire for knowledge, and the capacity for learning, of which he felt himself to be possessed."

From his earliest days, he was possessed of a wondering admiration for the works of Nature, a love which by degrees strengthened into absolute devotion. Always reverent, always fresh, it was a constant source of relaxation to him throughout his life, and remained undiminished to the last. Nothing was beneath his notice, "a wayside flower, a coloured moss, a tiny insect would move him to the depth of his being," and provide food for observation, study, and reflection. Every specimen he could collect, at home from the water-butt, on the beach from the fishermen's nets, was carefully studied with the aid of such books as he could procure. Under the spell of these studies, and as the result of his intercourse with Harrison, it is not surprising that his thoughts turned from the sea to become fixed upon medicine. At last, arrived to him the tide of his great opportunity, which, taken at the flood, led to a fortune, unparalleled in the history of medicine. The treasurer offered him a post in the counting-house at Guy's, using the words so often quoted by Gull in after years, "I can help you, if you will help yourself." In September 1887, provided with two rooms in the Hospital, and fifty pounds a year, Gull began his life's work. His first duty was to copy out in fair hand the catalogue of the Guy's Museum, drawn up by Thomas Hodgkin, the well-known pathologist, and first Curator of the Museum, and demonstrator of morbid pathology in the medical school—now independent, for the last bond of union with St. Thomas's had been snapped in 1836.

Continuing to work at Greek, Latin, and mathematics, Gull was able to matriculate, in 1838, at the newly-founded University of London. Harrison at once procured for him a free entry to the Guy's School of Medicine, by proposing, at a meeting of the staff, that William Gull should be made a perpetual student of the School. He thus escaped, most fortunate for him, the many disadvantages attaching to the apprentice system then in vogue; a relic of the dark ages, happily now extinct, whereby men gained a practical knowledge of bottle-washing and dispensing, and learned sufficient rule-o'-thumb midwifery, minor surgery, and drugging to enable them to act as unqualified assistants, relieving their principals of much drudgery, and paying for the privilege into the bargain. Gull at once began to display the "remarkable intelligence, assiduity, and power of work, which were his great characteristics through the whole of his life," by taking most of the Hospital prizes; in one year he gained every one. In 1841, he took the "College," and, later in the year, his M.B., obtaining honours in physiology, medicine, and surgery. He always referred with gratitude to the kind help and encouragement which he received in his work from the various members of the staff, specially instancing Benjamin Guy Babington (Bright's brother-in-law) and Mr. Stocker, the resident apothecary to the Hospital. In 1842, the treasurer appointed him to teach Materia Medica, and gave him, for residence, a small house in King Street (now Newcomen Street), where the porter's lodge now stands. This was the first of a series of appointments, which Harrison, without consulting any one, created for the benefit of his valuable *trouvaille.* In 1843, he took over from Golding-Bird the lectureship on Natural Philosophy, and was appointed medical tutor and assistant to Mr. Stocker, sharing, with that enthusiastic and devoted servant of Guy's, the care of the medical wards in the absence of the staff. These duties entailed daily visits to the wards, and seeing all the medical cases brought up for treatment, for H.P.'s were still in the lap of the gods. His close association with Stocker was by no means the least of Gull's advantages, for, besides other excellences, Stocker was the finest clinical physician of the day; a fact fully recognised by the whole staff, because, when any of them were ill, they always put themselves entirely in his hands. Gull was also librarian, and the medical superintendent of the lunatic wards, now the "Clinical House." Owing to his influence with the treasurer, these wards were converted, in 1859, to their present important use, and accommodation for the former inmates found in more appropriate institutions. In order to carry out the alteration, a special Act of Parliament was needed, but the expense incurred has been repaid many-fold by the value of the work done under the new conditions. For the benefit of the uninitiated, it may be explained that the beds in "Clinical" are reserved for cases (male and female) presenting features of special clinical interest. The full reports on these cases, compiled by the clinical assistants, a senior appointment held by picked men, serve as the basis for the clinical lectures on medicine, a weekly function at Guy's, dating back almost to the opening of the Hospital.

Under the conditions, in which Gull was placed, and remained for several years, living on the spot, cognisant of everything that was happening, responsible for the care and treatment of numbers of serious cases, and, moreover, always increasing his own knowledge by having to teach, it is not in the least surprising that, being equipped with a powerful intellect, and, with a bent of mind, that only found its natural satisfaction in the accurate methods of scientific thought, he should have built up that massive foundation of experience, upon which was based the matured opinion of after years. He frequently spoke of the invaluable opportunities he enjoyed of becoming acquainted with diseases of all kinds, and in every variety of aspect. Scorning delights, and living laborious days, he lived up to these inestimable advantages, and was to be found in the wards, at all hours of the day and night, seeking, by observation and experiment, for more light. In 1846, he proceeded to the M.D., obtaining the gold medal for his commentary in medicine; first of many hailing from the Boro'. Curiously enough, he was about to leave the examination-room, because, so he said, he knew nothing about the case given for commentary, but he was induced by friendly advice to attempt the task; a lack of self-confidence, which was a rare occurrence in Gull's life. While reading mental philosophy for the M.D., he was in the habit of holding long conversations with Frederick Denison Maurice, then chaplain to the Hospital, 1836–1846, and began to take an interest in metaphysics. The close and intimate association existing between these two remarkable men undoubtedly influenced Gull's whole life. Through Maurice, he was led to devote some of his leisure to the great English writers, of whom Shakespeare, Milton, and George Herbert became his favourites. His fondness for discussing philosophical questions dates from this time, for, in spite of an eminently scientific temper of mind, he was not content with materialism. The selection of notes and aphorisms, given by Acland, shows how deeply he pondered over the profundities of modern thought.

In 1846, the lectureship in physiology was instituted at Guy's, Gull being appointed to the chair. His indefatigable friend also made him Resident Physician to the Hospital, and gave him the house in St. Thomas's Street, at the corner of the front quadrangle, now occupied by the Chaplain. He had already begun to acquire a practice outside the Hospital. A chance consultation with a practitioner in the Boro', led to others, because "he always gave satisfaction." In 1847, he was elected Fullerian Professor of Physiology at the Royal Institution, where he formed a close and lasting intimacy with Faraday. He held this appointment for two years, and his lectures were said to have been unusually successful. In 1848 he became F.R.C.P., and, soon after his marriage to Miss Lacy, moved from Guy's to Finsbury Square. He was appointed assistant physician to the Hospital in 1851, and, in 1856, left the chair of physiology to lecture on medicine, conjointly with Owen Rees holding this post until 1867. He became full physician in 1858, on the death of Marshall Hughes; a promotion which brought Pavy on to the staff as assistant physician. He retired from his hospital work in 1868, and was made consulting physician in 1871. His retirement promoted Wilks to full physician, Hilton Fagge filling the vacancy in the junior grade, following closely on the heels of Walter Moxon. In 1858 he was elected F.R.S., on the council of which he served for several years. Oxford made him a D.C.L., in 1868; Cambridge a LL.D., in 1880; Edinburgh a LL.D., in 1884. From 1856 to 1889, he served on the Senate of the University of London, being the first medical graduate nominated to that body. He was the Crown representative on the General Medical Council from 1871 to 1883, serving again, in 1886 and 1887, as the representative of his University. In 1871 and 1872, he was President of the Clinical Society.

Gull's written contributions to medicine were not numerous, and were mostly published in the *Guy's Hospital Reports*, a few appearing in the *Transactions of the Clinical Society* and of the *Medico-Chirurgical Society*. They all contain original observations of importance, unobtrusively recorded in concise terms, and, for the most part, open up new paths for subsequent workers. His first published paper was written in conjunction with Addison on Xanthoma, called by the authors vitiligoidea. In this the affection was described for the first time. In 1854, in conjunction with Dr. Bailey, he drew up, for the College of Physicians, the Report on Cholera, which contains much important information about the pathology and treatment of the disease. Two years later came a remarkable paper on paraplegia, a subject to which two subsequent papers were devoted. These are considered to include some of his best work, notably in the preparation of the sections showing degenerative changes in the different tracts, at a time when microtomes and staining agents were not available. In his Gulstonian lectures (never published), he dealt with cerebral abscess, and, in conjunction with Sutton, wrote on the same subject in *Reynolds' System*. The best known paper is that (with Sutton) on "Arterio-capillary Fibrosis," showing that chronic Bright's disease is not merely local in the kidney, but is of the nature of a general vascular degenerative change. The "Report on Cases of Acute Rheumatic Fever, treated with Mint-water," also written with Sutton, appeared in the *Guy's Reports*, and gave rise to a discussion lasting until the value of salicylates was recognised. The part played by the mint-water in the treatment was that of a mere placebo, the real treatment adopted being absolute rest in bed, with the affected joints wrapped in cotton-wool, and the pressure of the bed-clothes kept off by cradles, while sufficient opium was given at night to ensure sleep and freedom from painful startings of the joints. The patient was screened off from the ward, allowed no visitors, and not permitted to be moved, even for auscultatory purposes. His last important work was the paper "On a Cretinoid Condition in Adult Women," describing, for the first time, the condition now known as myxœdema, although Gull's original name better indicates its true pathological relations.

The most notable event in Gull's professional life was his attendance upon King Edward, then the Prince of Wales, during his severe attack of typhoid at Sandringham, in 1871. Sir Oscar Clayton, who had been summoned to Sandringham, by Mr. Lowe, the local doctor, sent for Gull, and Jenner was called in shortly afterwards. Jenner it was, and not Gull, as Wilks reminds us, who had made a special study of typhoid, and pointed out its separate entity from typhus. Gull, as a matter of fact, had been at first opposed to the new views, following Bright and Addison, who lectured on the two diseases under the one name of "common continued fever." The following passage from the *Times* of December 18, 1871, shows Gull's wonderful powers of endurance, and the meticular care bestowed to ensure that his axiom of "what is best for the patient" was faithfully carried out. "In Dr. Gull were combined energy that never tired, watchfulness that never flagged; nursing so tender, ministry so minute, that, in his functions, he seemed to combine the duties of physician, dresser, dispenser, valet, nurse—now arguing with the sick man in his delirium, so softly and pleasantly that the parched lips opened to take the scanty nourishment, on which depended the reserves of strength for the deadly fight, when all else failed, now lifting the wasted body from bed to bed, now washing the worn frame with vinegar, with ever ready eye and ear and finger to mark any change and phase, to watch face and heart and pulse, and passing at times 12 or 14 hours at that bedside. And when those hours were over, or while they were going on—what a task for the physician! —to soothe with kindest, and yet not too hopeful, words, her whose trial was indeed great to bear, to give counsel against despair, and yet not to justify confidence." Appointment to the Royal Households and a baronetcy naturally followed the recovery of the august patient.

Gull was already in the full tide of success and popularity as a physician, when his share in the happy issue of the heir-apparent's sore affliction brought him world-wide celebrity. He had migrated west to Brook Street, in 1862, but had left nothing behind him in Finsbury Square, for "once they had seen him, his patients remained steadfast and seldom repaired elsewhere." He now became overwhelmed with work, and remained overworked so long as he remained in practice. "There was no one," writes Wilks, "whose opinion was more sought after, and, when obtained, more relied upon. This was due to his extensive and thorough acquaintance with every subject in medicine, gained by his indefatigable industry when a young man, aided by his natural acumen, which gave him wonderful powers of penetration." Sir Samuel goes on to point out that this was not all, for others, like Addison (and we may add like Sir Samuel himself), possessed these qualities. Gull possessed, in addition, a personal influence over his fellow creatures such as is given to but few men. It was a natural gift, which strengthened with years, and was, it may be, to some extent cultivated. Besides this, he had acquired a knowledge of human nature fully as profound as his knowledge of medicine. "His striking presence, his searching scrutiny, his minute and deliberate examination of every case, and the few carefully and slowly uttered words, in which he delivered his judgment, sometimes with epigrammatic pungency, often with encouragement, and never without sympathy—all combined to give him an almost unequalled ascendency over his patients." "When Gull left the bedside of his patient, and said, in measured tones, 'You will get well,' it was like a message from above." His resemblance to the great Napoleon, a matter of frequent remark in his later years, was not only in face and form, but also in manner. This latter, always masterful, acquired at length something of imperiousness, while his exposition of his views became tinged with dogmatism; both combining to give that unconscious touch of egoism common to so many great men, which, however so much appreciated by disciples, and those seeking for light and leading, is naturally resented by equals in standing, whose *amour propre* is entitled to full consideration. Hence arose the professional troubles, in which he was involved on more than one occasion, and for which he incurred some degree of professional censure. These blocked the way for him to the highest and most honourable office a physician can occupy, the Presidency of his College. On every other ground, Gull was fully entitled to hold this great position, for he ever upheld the honour and dignity of the profession, which commanded his whole-hearted devotion.

It has sometimes been questioned whether, in playing, as he did with infinite skill, upon the minds of his patients and their friends, Gull's action was in strict accordance with ethical rectitude, and consistent with his avowed hatred of anything savouring of charlatanism or mysticism, but his conception of a medical man's duties and responsibilities was at once broad and particular. It was, as if he imagined himself in the position of a skilled navigator, upon whose knowledge of the effects of winds, currents, and tides, as well as of the existence of hidden dangers, depends upon the piloting of a vessel, however frail and weather-beaten, through stormy and tortuous passages, into a haven of safety. There must be the same instant judgment of seemingly insignificant details, born of observation and ripened by experience, the equally instant decision as to the course to take in moments of peril or difficulty, and withal the same self-reliance and full understanding of the capacities and capabilities of his charge. Here a slight touch of helm, there a change in the trim or set of a sail, taking advantage of every favourable slant, and forcing even adverse conditions to yield something of advantage. Hence, in treatment, Gull brought to bear psychical, fully as much as physical means, not infrequently to the exclusion of the latter, when he had sized up the mental condition of his patient. In solving the human problems before him, he never failed to take with the reckoning the personal equation, insisting that each case must be considered as "the disease and the person." "Never forget," he would say, "that it is not a pneumonia, but a pneumonic man, who is your patient. Not a typhoid fever, but a typhoid man."

His scepticism in therapeutics was tempered with discrimination, for he made full use of remedies, whose effects had been ascertained by trustworthy observation. The truly scientific frame of mind, such as Gull possessed to the full, refuses to bow the knee to the Baal of authority. He fought hard for the treatment of disease on rational principles, and succeeded so well that he was able to say in his later years, "One thing I am thankful that Jenner and I have together succeeded in doing. We have disabused the public of the belief that doctoring consists in drenching them with nauseous drugs." That it was generally supposed that Gull's scepticism in drugs was complete, and his treatment always "expectant," were, in a large measure, due to himself. He sometimes allowed zeal to outrun discretion in denouncing the crude empiricism in vogue in his student days, when the faith in pills and potions, bleedings and blisters, was almost unlimited. In reality, he steered the sound and reasonable middle course between the Scylla of polypharmacy, and the Charybdis of credulity. He held, in equal detestation, the ignorant foolhardiness of excess, and the fantastic futilities of the Hahnemann school, if that can be termed a school, which panders to ignorance.

At Guy's, the high standard established by Bright and Addison was maintained by Gull, and handed on to his successors enhanced in value. He "has left the mark of his impressive thought on the medicine of our day, and has moulded the shape of our theories, conclusions, and practice, to an extent, which can only be measured by a wide survey and a subtle insight into the changes which, during the last 40 years, have altered the whole character of our medical faith." For evidence, it is enough to point to the fact that one of the greatest works on medicine in our day, Fagge's *Medicine* to wit, was mainly the work of one of his pupils, and was brought to completion by another.

The end began, in 1887, with an attack of right hemiplegia with aphasia, from which he made a slow recovery. None knew better than he the real import of this, and he remarked: "One arrow has missed its mark, but there are more in the quiver." More were launched at him at intervals until January 28, 1890, a final attack of cerebral hæmorrhage, causing aphasia and coma, brought to its close a useful and laborious career. He retained his faculties to the last, and, with them, his deep gratitude to Harrison, and his enduring affection for the place so long his home, the scene of his early labours and triumphs. "I look back," he told his audience at Guy's, in 1874, "with pleasure to the time, when I had no world but the wards of this hospital, and often regret, I am now so separated from them. All the success I have had springs from Guy's, and here are my early and best associations."

He rests in the churchyard of his childhood's home beside his father and mother.

Who is the happy warrior? Who is he
That every man in arms should wish to be?
It is the generous spirit who, when brought
Among the tasks of real life, hath wrought
Upon the plan that pleased his childish thought;

* * * *

Who, doomed to go in company with pain
And fear, and bloodshed, miserable train!
Turns his necessity to glorious gain;
In face of these, doth exercise a power
Which is our human nature's highest dower:

* * * *

'Tis he whose law is reason; who depends
Upon that law, as on the best of friends.

NOTES FROM FOREIGN JOURNALS.

TREATMENT OF INTERTRIGO IN THE ADULT.

This troublesome affection of the obese is due to the presence of the streptococcus. Sabourand advises, in the slighter forms, a weak alcoholic solution of iodine:—

℞. Tinct. Iodi.	ʒj.
"Eau de Cologne"	ad ʒx. M.

or of tar:—

℞. Liq. Picis Carbonis	ʒij.
"Eau de Cologne"	ad ʒx. M.

or of ichthyol:—

℞. Ichthyol	gr. xliv.
Aq. destill.	℥j. M.

In more severe forms, swabbing with nitrate of silver solution, 1 in 15 or 1 in 10, is useful, and also permanganate lotion, 1 in 5,000 to 1 in 1,000. The application of either of these may be followed up with the use of this ointment:—

℞. Zinci Oxidi	℥ss.
Bismuthi Carb.	gr. xx.
Adipis Lanæ Hydrosi.	
Paraffini mollis	āā ʒiiss.

Misce. Fiat unguentum. Nocte maneque applicand.

The paste remaining on must first be removed, at each fresh dressing, by a light rubbing with vaseline, as water will not remove it. The fresh application of the paste is made after drying the parts.

In obese women, in whom not only the groins but the vulva are involved, with œdema of the labia and intense pruritus, the affected parts must be washed with one of the above solutions, and then covered with a paste. Weak peparations of cade-oil are very useful.

℞. Olei Cadini	ʒiss.
Zinci Oxidi	ʒj.
Ichthyoli	āā gr. xv.
Resorcini	
Olei Betulæ Pyrolignei.	♏xx.
Paraffini Mollis.	āā ℥ss.
Adipis Lanæ Hydrosi	

Misce. Fiat unguentum.

X-ray treatment affords great relief, 3 Holzknecht's units being given at each exposure. The urine should be examined for sugar. If this is present, appropriate treatment must be instituted. If the urine is normal, a gentle laxative should be taken every morning, such as a teaspoonful of sulphate of soda in a tumblerful of water before breakfast, Avoid strong wines and spices; very little meat should be taken, and, if the pruritus is severe, this may be stopped for a time.—(*Journal des Praticiens.*)

CONJUNCTIVAL DIAGNOSIS OF ENTERICA.

Chantemesse brought forward this subject, at a recent meeting of the *Académie de Médecine.* He stated that von Pirker, of Vienna, in May, communicated to the Berlin Medical Society the fact that, in persons suffering from tuberculosis, the application of a little tuberculin to a raw place on the skin produces a characteristic reaction, which is absent in the case of healthy people. Shortly afterwards, Wolff-Eisner announced to the same Society that a well-marked conjunctival reaction was produced when tuberculin was instilled into the eye, in the case of tuberculous patients only. These observations have been confirmed in France, and Chantemesse was led to try if the conjunctiva was similarly sensitive, in typhoid fever, to a typhoid toxine. For the purpose, he made use of a toxine, dry, reduced to powder, capable of being weighed, and active to a fraction of a milligramme. This powder was obtained, by precipitation, from a strong solution of typhoid toxine by means of absolute alcohol. One-fiftieth of a milligramme of this, dissolved in a drop of water, and instilled under the lower lid, gave clear evidence of the absence or presence of typhoid fever in the subject under observation. The test has no drawbacks ; the temperature and general condition are not affected. In healthy persons, or in those suffering from any other disease than typhoid, there is caused, two or three hours after the instillation of $\frac{1}{50}$th of m.g. of toxine, a little redness and lacrymation, which disappear in three to five hours, and, on the following day, no difference can be noticed between the two eyes. In patients, in any stage of enterica, including convalescence, the reaction is very marked, reaching its maximum between six to twelve hours after instillation, and lasting till the following day. It is characterised by redness, lacrymation, and the production of a sero-fibrinous exudate. Twenty-four hours after instillation, the eye treated can still be recognised by the slight redness, and this usually persists for two, or even three, days. Chantemesse is unable to say definitely how early in the disease the reaction can be obtained. The conjunctiva of a rabbit shows it 48 hours after inoculation, under the skin, with typhoid bacilli. After an experience, now of some extent, he is convinced that the test is free from danger, and allows the physician to recognise with certainty, in a few hours, whether a patient is or has been suffering from typhoid fever.—(*Revue de Thérapeutique.*)

CONJUNCTIVAL REACTION TO TUBERCULIN.

Two communications on this subject have been made by Comby to the *Société Médicale des Hôpitaux.* In his earlier trials, he instilled one drop of one-per-cent. solution of tuberculin into the inner angle of the eye ; but finding, in one or two cases, that the swelling and secretion produced were so abundant, he now uses one drop of a half-per-cent. solution. When a positive reaction is obtained, there is congestion of the conjunctiva, with swelling of the mucous membrane, lacrymation, and a slight secretion of sero-pus. Comby looks upon this conjunctival reaction as an excellent method for determining the presence of latent tuberculosis, and it is quite as suited to febrile, as to afebrile conditions. When the reaction does not occur, the patient is not tuberculous. Comby has been able to prove this by post-mortem examination. The method is harmless, and the conjunctivitis is temporary. Dufour and Bruslè are able to confirm the value of the method by independent observations.

THE TESTICLE IN RENAL COLIC.

In the *Münchener medizinische Wochenschrift*, attention is drawn by Bittorf to the fact that not only does the pain of renal colic radiate to the testicle, but also that when pressure is made upon the testicle on the affected side, the pain caused radiates upwards to the kidney, producing, in the region thereof, a sharp pain if the colic is due to a stone in the kidney. When the crisis has passed, no pain is caused by squeezing the testicle. In a woman, the same ascending painful radiation is brought about by compression of the ovary. The explanation probably lies in the fact that the spermatic plexus is an offshoot from the renal plexus. Clinically, the symptom is of great value, from a diagnostic point of view, as it serves to distinguish renal colic from hepatic colic, or an intestinal affection.

THE THERAPEUTICS OF THE MOTOR-CAR.

Le Gendre has observed and reported the effect of the automobile upon the skin, the sense-organs, the air-passages, the circulatory, digestive, and locomotor systems, and also the nervous system. Mouneyrat, in the *Comptes rendus de l'Académie de Science*, relates his observations of the influence of motoring upon the general nutrition of normal people, and upon that of anæmic and neurasthenic patients. For the purposes of his paper, the author has made repeated trips in a motor, lasting eight to ten days, at a mean speed of 40 kilometres an hour, and a daily run of 100 to 200 kilometres. The runs were made in spring and summer. After counting the number of red-blood corpuscles, and estimating the amount of hæmoglobin, Mouneyrat is of opinion that, thanks to the free air-supply obtained, there is a marked increase in the number of the red cells and in the amount of hæmoglobin not only in healthy subjects but in anæmic persons. He has come to the conclusion that the automobile at a moderate speed is the treatment *de choix* for anæmia. The amount and character of the urine, like the increased appetite, all go to prove the greater activity of the processes of nutrition. In addition to the foregoing, motoring promotes sound sleep in healthy persons, and does away with the insomnia of neurasthenic subjects. This soporific effect is not sufficiently explained, according to Mouneyrat, by the fatigue induced by sitting in the car, by the open air and its "douche" action on the nervous system, and by the hæmatosis set up. He believes that, in the air of the fields and of the woods, there exists a special constituent, as yet unknown, which promotes sleep by producing relaxation of the nervous system.

RESUSCITATION AFTER DEATH FROM ANÆSTHETICS AND ASPHYXIA.

In the *Journal of Experimental Medicine*, Crill and Dolley report upon their researches on this subject as carried out upon dogs. They have found that Ringer's solution gives more favourable results than saline solution as an infusion, and that the most satisfactory results were obtained when the infusion-bottle was at a height of five or six feet. They have come to the following conclusions, based upon the results of their own and similar observations:—

1. Animals after death from chloroform, ether, or asphyxia up to five minutes were uniformly and readily resuscitated; up to 10 minutes there was an occasional failure; beyond 10 minutes consciousness was rarely restored, and the proportion of successes in the resuscitation of the circulation and the respiration diminished with the lapse of time; after 23 minutes in adult dogs, and 35 minutes in puppies, return of the circulation was not accomplished.

2. After death from chloroform and ether, animals were more readily

resuscitated than after death from asphyxia.

3. Resuscitation, if successful, occurred within one minute after the administration of adrenalin in the majority of instances; it rarely occurred after an interval greater than three minutes.

4. The greatest difficulty to be overcome was clotting. The probability of clotting increased in direct ratio with the lapse of time after death. Cardiac trauma predisposed to clotting.

5. The younger the animal, up to certain limits, the more readily it was resuscitated.

6. Any artery may be used for the infusion, though the advantage is probably slightly in favour of the carotid. The infusion should be directed towards the heart.

7. The probable success of resuscitation is greater in inverse relation to the lapse of time after death; a rapid rise in the arterial pressure is attained by arterial infusion with a therapeutic dose of adrenalin, together with good artificial respiration, and the avoidance of unnecessary cardiac trauma by massage. All artificial aids should cease as soon as the functions are competent.—(*Therapeutic Gazette.*)

EFFECT OF BATHS AND SWEATING IN NEPHRITIS.

Strasser and Blumenkranz have made obervations upon patients, suffering from different degrees of chronic parenchymatous nephritis, and find that baths at 34° C. (93·2° F.), of one hour and a half's duration, always produce increased diuresis, and elimination of chlorides. There is also an increase in nitrogenous elimination, but it is variable and less marked. The effect is only produced on the day of the bath, and does not last into the succeeding days. It is supposed that there is an actual renal effect, apart from that on the circulation, and the bath treatment was combined with reduction of the intake of sodium chloride. In the case of a child, suffering from acute scarlatinal hæmorrhagic nephritis, milk diet and a daily bath of one hour's duration were prescribed. Three times in the course of treatment the bath was omitted, and the action of the kidneys was at once influenced unfavourably. The opposite experience, obtained by increasing the supply of salt, showed that, in patients with chronic Bright's disease, diuresis is decreased, and the bath treatment afterwards brings about an exaggerated excretion of chlorides. They conclude, therefore, that this treatment should be instituted forthwith when such cases present œdema, or symptoms of uræmia. It is easy to keep the bath at the proper temperature, by covering it with a sheet, and adding further supplies of hot water from time to time, after letting some of the bath water run away. After the bath, the patient is put to bed, without being dried, well covered up, and left to rest for one or two hours. Two baths of one hour each a day is the most suitable dose. In patients with arterio-sclerosis and showing uræmic symptoms, headache and nausea are produced.

Experiences with the electric-light bath at 55° C. (131° F.) showed that, in spite of an elimination by the skin of about 270 g., the quantity of urine was only reduced by 100 g., and, on the ninth day of this treatment, œdema of the face appeared with headache and nausea.

The authors consider that this shows that, when sweating is employed, it is necessary to avoid high temperature baths.—(*Blätt. fürklin. Hydrotherapie.*)

Reviews of Books.

A System of Medicine. By eminent authorities in Great Britain, the United States, and the Continent. Edited by WILLIAM OSLER, M.D., F.R.C.P., F.R.S., Regius Professor of Medicine in Oxford University, formerly Professor of Medicine in Johns Hopkins University, Baltimore, in the University of Pennsylvania, Philadelphia, and in McGill University of Montreal; assisted by THOMAS McCRAE, M.D., F.R.C.P., Associate Professor of Medicine and Clinical Therapeutics in Johns Hopkins University, Baltimore. In seven octavo volumes of about 900 pages each. Illustrated. London: The Oxford Medical Publications. The set, per volume, cloth, 24s. net. A single volume, 30s. net.

VOLUME I. of this System of Medicine contains the following sections:—Evolution of Internal Medicine; Predisposition and Immunity; Diseases caused by Physical, Chemical, and Organic Agents, by Vegetable Parasites, by Protozoa, by Animal Parasites; Nutrition; Constitutional Diseases. The introduction on the evolution of internal medicine is written by Professor Osler, and is of the utmost interest to the student of medicine. It takes a masterful survey of the whole subject. The chapter, dealing with inheritance and disease, is from the pen of Professor J. G. Adami, than whom, upon those subjects, there is no greater authority. Dr. Alonzo Englebert Taylor has contributed two excellent chapters, one on auto-intoxications in general, the other on auto-intoxications associated with protein, purin, carbohydrate, and fat metabolism. To these we would especially draw the attention of the clinician. All those interested in tropical medicine should read the excellent articles upon "Diseases caused by Protozoa." These are contributed by Dr. Gary N. Calkins, Dr. Charles F. Craig, Dr. I. W. W. Stephens, and Colonel David Bruce, C.B., F.R.S.

Volume II. deals wholly with the Infectious Diseases. Here we especially direct attention to the article, consisting of 160 pages, on Typhoid fever, which has been written by Dr. Thomas McCrae, and which is, we believe, one of the most complete of its kind. There is also a carefully written article on Diphtheria by Dr. John H. McCollom, and an exhaustive article on Lobar Pneumonia by Drs. John H. Musser and G. W. Norris. We are glad to find that the article, dealing with Acute Rheumatism, has been contributed by such an authority as Dr. Frederick J. Poynton. The work throughout is of the highest degree of merit, and if the subsequent volumes maintain the same standard of excellence as those to which we have referred, there will be at the service of every practitioner one of the soundest and most complete reference books on Medicine ever published. An advantage offered by the publishers is that single volumes of the work may be obtained, so that those specially interested in some particular branch of medicine will be able to obtain what they require without unnecessary expense.

Inflammation: an Introduction to the Study of Pathology. By J. GEORGE ADAMI, M.A., M.D., F.R.S., sometime Fellow of Jesus College, Cambridge; Professor of Pathology, McGill University, Montreal. Pp. 240. London: Macmillan & Co. 5s. net.

THIS small volume is a revised and enlarged reprint of an article on inflammation in Professor Allbutt's *System of Medicine.* Professor Adami points out, in his preface, that "a knowledge of the inflammatory process is the foundation of all pathology," and, moreover, that, as inflammation briefly is the local reaction to injury, if we are to understand disease at all, we must first gain a knowledge of what constitutes the inflammatory process. The book before us is, so far as we know, the best monograph upon the subject with which it deals, and we consider that it should be carefully read, not only by medical students, but by *all* students of medicine. Professor Adami speaks with authority, and it is an authority which we may safely follow.

Studies in Clinical Psychiatry. By LEWIS C. BRUCE, M.D., F.R.C.P., London: Macmillan & Co. 12s. 6d.

UNDER this modest title, Dr. Bruce gives a luminous account of the clinical features of psychiatry. Hitherto, there has been too great a tendency to look upon mental disorder as a primary disease which secondarily affects the bodily functions. Such a view has a depressing effect upon treatment, which can be little more than symptomatic, and is repudiated by the author.

The application to mental disorders of the methods of clinical pathology, particularly examinations of the blood and urine, has led Dr. Bruce to many interesting discoveries, which have an important bearing on ætiology and treatment. Most mental cases show symptoms to toxæmia, which may be metabolic, as in acute melancholia, or point to bacterial infection, *e.g.*, mania. Further, in this second group, the actual determination of insanity would appear to depend less on any specific infection than on an insufficiency of the normal protective mechanism.

In the short space at disposal, it is impossible to follow further, or do adequate justice to Dr. Bruce's fascinating researches. The book is of absorbing interest not only to the alienist, but also to the general physician who has the opportunity of seeing mental cases in the hopeful early stages.

A Manual of Midwifery. By THOMAS WATTS EDEN, M.D., F.R.C.P., Assistant Obstetric Physician and Lecturer on Practical Midwifery, Charing Cross Hospital. With 26 plates and 233 illustrations in the text. London: J. & A. Churchill. 10s. 6d. net.

IN this book Dr. Eden has set himself the task of setting forth a concise account of the present position of the theory and practice of midwifery, which should not exceed the compass of the average student's, or the average practitioner's reading, and has succeeded admirably in his self-imposed task. Having incorporated the most recent advances in connection with the development of the human ovum, and the pathology of pregnancy, and having presented such practical subjects, as the management of labour, and obstetric surgery in the light of the most recent clinical data, Dr. Eden has succeeded in producing a guide to that practical and adequate knowledge of midwifery, which is essential to the student, who desires to satisfy examiners, as well as to the practitioner, whose early years and practice are often so largely employed with obstetric work. A special feature of the work is the wealth of its illustrations, the majority of which are borrowed from well-known sources.

We warmly commend this manual of Dr. Eden's to the practitioner and student, who will find in it a safe guide to the practice of midwifery.

The Skin Affections of Childhood, with Special Reference to those of more Common Occurrence, and their Diagnosis and Treatment. By H. G. Adamson, M.D., M.R.C.P., Physician for Diseases of the Skin, Paddington Green Children's Hospital, etc. Pp. 287. Illustrated. London: Oxford University Press. 5s. net.

This volume calls for highest praise. The author has given a most lucid account of the common skin diseases of childhood, and excellent illustrations throw light upon the distribution and characteristics of many of the affections described. Naturally, space is devoted chiefly to the commonest diseases, and consequently a large amount of space is allotted to ringworm and its treatment. Evidently Dr. Adamson is strongly in favour of the X-ray treatment of this disease, which is described in great detail, and will be welcome to many who are unfamiliar with the technique and details of procedure. The Finsen-light treatment of lupus is also described with care. We could wish that, out of the fulness of his experience, the author had said more about the applications which are of value in some everyday diseases, such as infantile eczema, or in pediculosis capitis; but such directions, as are given, are lucid and concise. An appendix is given including formulæ of lotions, ointments, and other applications which should be of value. There is little to criticise in Dr. Adamson's book. He is to be congratulated upon accomplishing his task so admirably, and his book cannot fail to be popular, as it deserves to be.

The $CHCl_3$*-Problem.* By Richard Gill, B.Sc., M.B., B.S., F.R.C.S. (Eng.); Chief Chloroformist to St. Bartholomew's Hospital. 2 volumes. Pp. 301 + 289. London: William Blackwood & Sons.

The causation of the various phenomena, which accompany the induction and maintenance of chloroform anæsthesia, is subjected, in these volumes, to a most searching and critical analysis.

They cannot fail to be of the greatest interest to medical men, who have time at their disposal, whether they are habitually employed in administering anæsthetics or no, though perhaps they may not entirely agree with the author's conclusions.

Briefly stated, these are as follows:—

Chloroform, when limited to the anæsthetic degree, produces the least possible disturbance to the pulse, respiration, and nutrition generally; other anæsthetics fall short of perfection, either by excessive stimulation, which tends to exhaust the patient, or because their vapours are too heavy.

The sole objection to chloroform is its heavy vapour, which makes it easy to administer an overdose, though with proper care this contingency can always be avoided.

Antiseptic Methods for Surgical Nurses and Dressers. By HAROLD UPCOTT, F.R.C.S. Pp. viii + 51, and 10 illustrations. Crown 8vo. London: Baillière, Tindall & Cox. 2s. 6d. net.

THE author's aim has been to adapt his book to the needs of private surgical nursing homes, and, without supplanting the manuals, to collect in small compass the most essential facts with which the surgical assistant should be acquainted. He has succeeded in producing a capital little book, which points out, clearly and succinctly, the reasons underlying the various minute details, insisted upon in the elaborate ritual of modern aseptic operations, and combines therewith a practical description of these methods. Those, for whom the book is intended, will find it extremely useful, as it will enable them to comply with the utmost requirements of the most advanced devotees of high ritual in matters aseptic.

Notes on Blood-serum Therapy, Preventive Inoculation, and Toxin and Serum Diagnosis. For veterinary practitioners and students. By WALTER JOWETT, F.R.C.V.S., D.V.H., formerly Demonstrator of Comparative Pathology and Bacteriology in the University of Liverpool. Pp. x + 200. Illustrations 47. Crown 8vo. London: Baillière, Tindall & Cox. 5s. net.

THE author gives a short account of the subject of immunity, and of the vaccines, serums, and toxins used in present-day veterinary practice for the prevention, treatment, and diagnosis of disease. In compiling his notes, the author has, as the bibliography shows, covered a great deal of ground, especially that yielding the latest information on the subject. There is much practical information, and a useful note is added on the occurrence of spirochætæ in equine "canker" and "grease." There is in the book much that is interesting, and not a little that is instructive to students and practitioners of medicine.

Text-book of Comparative General Pathology for Practitioners and Students of Veterinary Medicine. By Prof. Dr. TH. KITT, of Munich. Authorised translation by Drs. W. W. CADBURY and A. J. SMITH, of the University of Pennsylvania. Pp. xiii + 471. London: Baillière, Tindall & Cox. 25s. net.

THIS volume, by the well-known authority Prof. Kitt, furnishes veterinary students with an excellent text-book of general pathology, and students of human pathology will also find it useful. The first 100 pages deal fully with the conceptions of disease, causes of disease, and general principles in a thorough manner; then follow circulatory disturbances, disturbances of metabolism, retrograde disturbances, the degenerations and necrosis, processes of repair, inflammation, tumours, and functional disturbances. Infective agents and immunity might, perhaps, have been dealt with at greater length with advantage. The work is illustrated with a number of excellent figures in the text, and with four coloured plates.

Notes by the Way.

The Lower Age-limit for School Attendance.

An important article on the desirability of prohibiting the attendance at school of children under five years of age, from the pen of Dr. Arthur Newsholme, Medical Officer of Health for Brighton, appears in this month's issue. In it he maintains that, educationally, the attendance of children under five is useless, and points out that this view is practically endorsed by recent official pronouncements. On economical grounds, he argues in favour of the establishment of crèches, thus leaving the vacant school places to be occupied by older children, for whom accommodation is needed.

The chief evils of school attendance under five, or even under six, demand the anxious consideration of our educational authorities, for they are declared to be the teaching of reading from books, or writing on slates or paper, a necessary result of which is injury to the undeveloped eye, the general effects of breathing polluted air, and the dissemination of infectious diseases, and the statistics furnished by Dr. Newsholme prove that this is no fanciful picture. There is no doubt whatever, that in a good home, in healthy surroundings, under suitable discipline, a child had better be left free, until six or even seven years of age. The brain, in such circumstances, will be better matured and developed, and the body better able to resist the attacks of disease. In country districts, too, it is far better for the young life to be free to breathe unpolluted air, and to become well developed physically. But we must admit that an almost insurmountable difficulty is met with in dealing with crowded centres of population. In these, as Mr. G. L. Bruce has pointed out, it seems more certain that the children are better at school than playing in the street, or on the staircase of a model dwelling, from morning till night. Moreover, as most educational experts maintain, it is of the utmost importance that habits of obedience, and general disciplinary measures should be inculcated at a very early age, if there is to be efficient training and instruction later. We believe that it was Cardinal Wiseman who said "give me the children up to five and you may do what you like with them afterwards." In this, as in most important questions, *audi alteram partem* is a golden rule, but whether it is dealt with, as Mr. A. J. Mundella urged, by not excluding those under five, but by reforming the schools, or by the establishment of crèches, as advocated by Dr. Newsholme, it is evident that the matter is both serious and pressing, and should receive the immediate attention of the Legislature.

It appears, however, from a recent decision of the Board of Education that there is no legal obstacle preventing an education committee from establishing a public elementary school, restricted to children under five years of age, with a specially adapted curriculum. Although such schools would scarcely be of the nature of crèches, they would, if generally established, go far to meet the existing difficulty.

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Marriage with a Deceased Wife's Sister or with a Deceased Husband's Brother.

When a sensible man was asked whether he objected to the legalising of marriage with a deceased wife's sister, he replied that there could not be the slightest objection to such a law, provided that it was not made compulsory. Most intelligent persons would take the same view, as there cannot be the smallest objection to such a marriage on the ground of consanguinity. But, in the voluminous correspondence, wise and otherwise, which has taken place in consequence of the recent passing of the Act, a curious question on the desirability or non-desirability of legalising marriage with a deceased husband's brother has arisen, and much has been said about the hypothesis of telegony, or the reproduction, in the offspring of one sire, of characteristics derived from a previous sire, to whom the mother has borne offspring. This theory, although at one time widely entertained, has we believe broken down under the test of careful experiment. "Characteristics" is a very wide term, and, of course, includes disease, and, physiologically, we know that a woman may acquire a disease from her husband, and transmit it to her child. In such a case, she ought not to have a subsequent child by her husband, or by any other man. If the term applies to the acquisition of consanguinity, it is clear that it would apply with greater force to her husband than to her husband's brother. We have yet to learn, however, that, if telegony were likely to occur, which is more than doubtful, it would furnish any argument against marriage with a husband's brother, and think that the opinion of Dr. P. Chalmers Mitchell is sound and sensible. He says "those who wish to legalise marriage with a deceased husband's brother, need not fear the existence of a physiological barrier; and couples, who have already one child, need not become Malthusians lest consanguinity acquired through the first child ruin the constitutions of subsequent children."

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The Mulkowal Incident and Mr. Haffkine.

WE are glad to see that Mr. Haffkine's case is being taken up in this country by men who are not likely to be satisfied with anything short of success. The recent letter in *The Times*, signed by Professors Ronald Ross, R. T. Hewlett, A. S. Grünbaum, W. J. Simpson, R. F. C. Leith, W. R. Smith, G. Sims Woodhead, E. Klein, Charles Hunter Stewart, and Dr. Simon Flexner clearly shows that the parliamentary papers, recently issued, contain not only no proof that Mr. Haffkine's laboratory was to blame for the Mulkowal accident, but the clearest evidence to the effect that it could have had nothing to do with the occurrence. That being the case, it is evident that the public announcements in official *communiqués*, placing the responsibility for the accident on the Bombay laboratory, have been issued on a wrong finding, and that a grave blunder has been committed, and a cruel injustice done to Mr. Haffkine, one of the most brilliant scientists of the day. Our sympathies are entirely with a movement having for its object the reversal of a finding against Mr. Haffkine, which an impartial review of the facts shows to be illogical and incorrect. There is another serious aspect to this question, and it is this:—One of the pillars of our strength in India is the confidence Hindus and Mohammedans alike have in British justice. But is there not danger that, so long as Indians can point to such a case as that of Mr. Haffkine, that confidence may be shaken?

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The Plague in India.

IT is said that an Irishman, on being called upon to plead "guilty" or "not guilty" to a serious charge, declined to do so, on the ground that it was impossible before he had heard the evidence. It is not always, however, that a correct view of a case is formed after the evidence has been considered, as has been shown in reference to the original finding in reference to the Mulkowal incident. It is now pretty conclusively established that the stigma, attaching to Dr. Haffkine, was undeserved, and that his consequent temporary removal from his valuable work in India was a mistake. His early return to the scene of his labours for the resumption of his researches and duties may be confidently looked for. In connection with this, we cannot help drawing attention to some facts concerning the plague, to which prominence has been recently publicly given. The population of India is a vast one, and when it is stated that, during eight years, five millions have died of the plague, there is a danger of overlooking the exact meaning of such a return, by a failure to compare the mortality with the calculated population. The proportion is by no means an alarming one, albeit it is sufficiently serious to demand the best efforts of sanitary authorities and of scientific experts in the direction of its reduction, and, if possible, of stamping out the disease.

The success, which has followed the measures taken for stamping out yellow fever in Havana, by working "on the line that the mosquito was the cause of the transmission of the disease," naturally suggests a similar course with reference to rats and rat fleas, which are the cause of transmission of the plague. This course, however, is more easily suggested than effectively carried out, for, as Mr. Haffkine says, in reference to the poisoning of rats on a large scale in Bombay, which was ineffective in checking the spread of the disease, "no poisoning operations can kill as many rats as the plague itself does every year," and these plague-killed rats are of course a prolific cause of the spread of the plague. Moreover, the greatest difficulty has been experienced in obtaining the co-operation of the natives, who, for some inexplicable reason, seem more ready to conceal the presence of a victim of the plague than they are to notify a case to the authorities.

While every effort is being made by the sanitary authorities for the improvement of the sanitary conditions of the homes of the people, and the surrounding districts, attempts must be made to overcome the prejudices of the natives against inoculation. These prejudices are deeply rooted, and oftentimes take the form of active opposition, for they are intimately connected with a grotesque, and not infrequent gruesome superstition. At the same time, there is no doubt that the task is not an impossible one, as is evident from the statement of the Rev. W. W. Holdsworth, until recently the senior missionary in the City of Mysore. It appears that, when the plague made its appearance there, he was able to persuade all the members of his church to be inoculated. But two little children happened at the time to be in delicate health, and it was not thought advisable to inject more than half the quantity generally used for a child. While the plague claimed thousands of victims, not one of the native Christians was attacked, with the exception of these two children, both of whom succumbed to the disease. Like others, Mr. Holdsworth expresses a hope that Mr. Haffkine may be allowed to continue his work on behalf of the long-suffering people of India.

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Notification of Births.

If the medical profession were really a well-organised trades-union, as is sometimes alleged by lay writers and speakers, Lord Robert Cecil's bill for bringing about a much-needed reform in the registration of births would most assuredly not have been allowed to pass in the form in which it finally became law. Evidently the desire to obtain credit for a little philanthropy at other people's expense proved too strong for the House of Commons to resist. It is a very human failing, but the members might reflect upon the fact that cheapness in philanthropy is rather more unsavoury even than in other commodities. It may be that the gentry of the long robe, finding themselves in a *rôle* altogether unassociated with their profession, were determined to get out by a short cut, and hence the little exhibition of chicanery to finally secure the passage of the bill. Having first appealed for the support of the doctors, in order to help forward a measure affecting the public weal, on the ground of the invariable readiness of their "noble (at this stage) profession" to do this even at the cost of some self-sacrifice, the House then proceeded to thrust upon them a public duty, not only without reward, but with the penalties of summons and fine attaching to non-performance. The Act at present is only adoptive; when it is made, as it should be, compulsory in all parts of the kingdom, these iniquitous provisions must be amended. So far as we know, the doctor will only have to make known the fact of a birth, for which purpose it is enacted, in a sudden fit of generosity, that he shall be furnished with a free supply of stamped and directed postcards. He will not be obliged, like his American *confrère*, to fill in details as to parentage, and will thus escape from the awkward predicament, in which one of the latter was once placed. He had attended, in her confinement, a Cyprian of local fame, and was by law bound to supply the name of the father of the child. He escaped from his difficulty by a happy circumlocution, for in the prescribed space he inserted the father's name as "E Pluribus Unum."

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Patent Medicines.

"A MAN," says the old saw, "is either a fool or a physician at forty." There is certainly no lack of opportunity, nowadays, for a man or woman to acquire, at a much earlier period of life, a vast amount of so-called information about most, if not all, of the functions of the body, as well as about infallible methods of putting these right, when they are out of order. Voltaire's gibe, at the doctors of his day, may or may not have been deserved, but it is very applicable, at the present time, to those who qualify as physicians by absorbing the the corroborative detail, teeming in the advertisement columns of the lay press, and also occasionally—*proh pudor!*—in those of professional journals. The passion for physic is so deeply ingrained, and so widely spread, as to suggest that it must be an atavic relic, having its origin in ghost-worship. It is most unseemly that any member of the profession should lend any countenance to what is, in effect, a form of degraded superstition; but, in moments of thoughtlessness, or to save trouble, it is not of infrequent occurrence. While this sort of thing continues, the evil will never abate. Nothing indeed will be of much avail, until the profession looks the question of compounding and supplying medicines fairly in the face, and determines to hand these matters over to the pharmacists, to whom they legitimately belong. Then the interests of prescriber and dispenser will be in harmony, and these can unite against the nostrum-monger with success, especially when, as must be the case ere long, the last-named is compelled to declare each and every ingredient in his box of mystery.

Practical Notes.

The Bony Orbit.—The orbital fossæ are somewhat conical in shape, with a roof, floor, outer and inner wall, a base, and an apex. The depth of an average orbit measures about two inches. The base is directed forwards and a little outwards, and corresponds with the aperture of the orbit. The upper margin is the part of the frontal bone which extends between the external and internal angular processes. The outer and half the lower margin are formed by the edge of the malar bone. The inner border and remainder of the lower margin are formed by the outer surface of the frontal process of the superior maxilla. The apex is directed backwards and inwards, so that the inner walls of the two orbits are nearly parallel to each other. At the apex, there are two openings, namely, the sphenoidal fissure and the optic foramen. Through the sphenoidal fissure, the third, fourth, ophthalmic division of the fifth, and the sixth nerves enter the orbit, the superior ophthalmic vein passes back through it to enter the cavernous sinus. There is also a process of dura mater entering the orbit, in which there is a recurrent meningeal branch from the lachrymal artery, which passes backward through the outer part of the sphenoidal fissure to anastomose in the middle fossa of the skull with the middle meningeal artery.

Just above and internal to the inner end of the sphenoidal fissure, there is the optic foramen, which transmits the optic nerve and the ophthalmic artery a branch of the internal carotid artery. Around the foramen there is a process of pia mater, outside of which is the vaginal lymph space, and this is surrounded by a process of dura mater which is attached to the walls of the foramen and to the optic nerve itself. The roof of the orbit is very thin, and is formed by the orbital plate of the frontal bone in front, and by a small piece of the smaller wing of the sphenoid behind. Under cover of the external angular process of the frontal bone, the roof is excavated, forming a fossa for the lachrymal gland. The floor of the orbit is formed by the orbital plate of the superior maxilla, the orbital surface of the malar bone, and the orbital process of the palate bone. In the floor is the spheno-maxillary fissure which transmits the superior maxillary division of the fifth nerve on its way to the infra-orbital canal, the orbital, or temporo-malar branch ot the same nerve, the infra-orbital vessels, and small branches from Meckel's ganglion. The spheno-maxillary fissure connects the orbit with the spheno-maxillary fossa behind, and the zygomatic fossa externally. The outer wall of the orbit is the strongest, where the greatest protection is required. It is formed by the orbital surface of the great wing of the sphenoid, and the upper part of the orbital surface of the malar bone. This outer wall is pierced in front by one or two small canals, which traverse the malar bone, and transmit the temporal and malar branches of the orbital nerve, a branch of the superior maxillary division of the fifth nerve.

The inner wall of the orbit is formed by the frontal process of the superior maxilla, by the lachrymal bone, the os planum of the ethmoid, and part of the lateral portion of the body of the sphenoid. Just above the os planum of the ethmoid are the anterior and posterior ethmoidal canals, which transmit the ethmoidal vessels, whereas the anterior one also transmits the nasal nerve. There is a vertical ridge on the orbital surface of the lachrymal bone, which is known as the lachrymal crest, and which forms the posterior portion of the lachrymal groove, the anterior portion of which is formed by the channelled posterior border of the frontal process of the superior maxilla. The lachrymal sac lies in the lachrymal groove. To the inner side of the lachrymal bone, and separated from the orbit by it is the infundibulum, or passage leading from the frontal and anterior ethmoidal cells into the middle meatus of the nose. It should be noted that the roof of the orbit is in close relationship with the frontal sinus and the anterior fossa of the skull; the floor is in relation with the maxillary antrum, the spheno-maxillary and zygomatic fossæ; the inner wall is in relation with the frontal, anterior, middle and posterior ethmoidal air cells, and with the sphenoidal air sinus near the apex of the space. The orbit communicates with the cranial cavity behind by the sphenoidal fissure and the optic foramen. Opening from the floor of the orbit on to the face, is the infra-orbital foramen, and from the roof on to the forehead is the supra-orbital notch, or foramen, which transmits the supra-orbital nerve and artery.

EXOPHTHALMOS, OR EXOPHTHALMIA.—Protrusion of the eyeball may be due to the various swellings which primarily arise in the orbit, but as the orbital cavity is so intimately related to other cavities, which lie in its boundaries, all these must be kept in mind when considering the various causes of exophthalmos. The roof of the orbit is separated from the anterior fossa of the skull by a plate of bone, which is decidedly thin in places. Below the floor of the orbit is the maxillary antrum. In relationship with the inner wall of the orbit are the frontal sinus, which sometimes extends over the anterior portion of the orbital roof, the anterior, middle and posterior ethmoidal sinuses, and towards the back is the sphenoidal sinus ; on the inner wall, too, the orbit is in relation to the nasal fossæ. Through the sphenoidal fissure and the optic foramen the orbit is brought into relation with the cranial cavity, and through the spheno-maxillary fissure with the spheno-maxillary fossa.

The causes of exophthalmos, which arise in the orbit, are as follows :—Effusion of blood into the orbit from local injury, orbital periostitis, orbital cellulitis, tenonitis or inflammation of Tenon's capsule, a serous capsule surrounding the globe and containing lymph ; a gumma, arising in the connective tissue or periosteum, tumours of the optic nerve, which are either intra-dural or extra-dural, and are probably endotheliomata, and tumours of the orbital tissue itself, simple tumours such as osteomata, dermoid cysts, parasitic cysts, meningoceles, and meningo-encephaloceles ; these grow slowly. Primary and secondary sarcomata, and secondary carcinomata, such as may arise from a case of carcinoma of the breast, as a rule grow quickly. Primary carcinoma occasionally arises from the lachrymal gland.

The causes of exophthalmos, which arise in the roof of the orbit, are those connected with injury, such as a fracture of the base of the skull, involving the anterior fossa, and consequently the orbital plate of the frontal bone. Tumours of the prefrontal lobes of the brain may encroach on the orbit through the thin bony roof.

The causes of exophthalmos, which arise in the inner orbital wall, are either the complications which sometimes follow nasal catarrh, or new growths, which arise in the nasal cavity. The former condition sometimes causes a catarrhal condition of the mucous membrane lining the frontal sinus, and, if the condition ends in a suppurative frontal sinusitis, the adjacent sinuses, such as the ethmoidal and sphenoidal, may be involved in the same morbid process. The frontal sinus, together with the anterior ethmoidal sinus, opens by the infundibulum into the middle meatus of the nose, the middle and posterior ethmoidal sinuses open into the superior meatus of the nose, the sphenoidal sinus opens into the nasopharynx, just behind the superior meatus of the nose. Simple polypi may, and, as a rule, the malignant polypi and sessile tumours of the nasal fossæ also cause the inner wall of the orbit to bulge out, and consequently develop exophthalmos with lateral displacement of the eyeball.

In the floor of the orbit is the maxillary antrum. Its cavity may be distended with a mucous exudation, a condition known as hydrops antri ; it may be distended with pus, a condition known as empyema antri, or there may be a new growth, such as an ivory or canallous, enostosis, which may distend the walls, raise the floor of the orbit, and produce exophthalmos.

At the back of the orbit is the sphenoidal fissure, at the back of which is the cavernous blood sinus, this occasionally becomes thrombosed, when exophthalmos follows. The thrombosis may be an extension from the intra-orbital veins, or it may be associated with intra-cranial sepsis, general pyæmia, or even anæmia. As a rule, with thrombosis of the cavernous sinus there is a transference of the symptoms to the opposite eye also.

It is rare for the orbit to be encroached upon through the spheno-maxillary fissure, but a secondary malignant tumour may be occasionally found growing in the spheno-maxillary fossa, the primary seat of such may be, for example, in a malignant thyroid gland. Such a tumour is likely to extend into the nasal cavities as well, causing there epistaxis.

The exophthalmos of exophthalmic goitre is usually bilateral, though often unequal, and is, as a rule, more apparent than real. This is due to the overaction of the unstriped muscle of Müller, which exists in the upper eyelid. At the same time, there is a certain amount of exophthalmos, which is partly due, at any rate, to the increased contraction of the unstriped muscle, which exists in the walls of the capsule of Tenon, which practically surrounds the posterior five-sixths of the globe. Other symptoms of exophthalmic goitre should be looked for, such as palpitation, tachycardia, some asymmetrical enlargement of the thyroid gland, muscular tremors, especially well seen in the hands, a general fidgety condition of the patient, and symptoms of gastro-intestinal irritation. The margins of the eyelids are unduly separated (Dalrymple's sign); the upper lid tardily follows the eyeball in its downward movements (von Graef's sign); there is diminished frequency of winking (Stellwag's sign); there may be an imperfect power of conveyance (Möbius' sign). The vision is usually normal.

PULSATING EXOPHTHALMOS.—This is a rare condition, and is due to an arterio-venous aneurysm, the communication taking place between the internal carotid artery and the cavernous sinus. This may follow a wound by a bullet, a racture of the middle fossa of the skull, or an operation, involving the roof of the naso-pharynx. It is said sometimes to occur without injury, and is then due to some arterial degeneration. Some cases of pulsating exophthalmos, however, are due to a traumatic aneurysm of the ophthalmic artery or one of its branches, aneurysm of the internal carotid itself, by pressing upon the superior ophthalmic vein as it enters the cavernous sinus, or a very vascular tumour growing in the orbit. If the pulsation is due to an arterio-venous aneurysm, or an aneurysm of the internal carotid, a bruit may be heard on auscultation over the eye or orbit, and pressure on the common or internal carotid, applied in the neck of the same side, will cause a diminution of the proptosis, and a disappearance of the bruit.

INTERMITTENT EXOPHTHALMOS.—This is a very rare condition, and is ascribed to a varicosity of the ophthalmic veins, the superior of which communicates with the angular vein, and the inferior with the pterygoid plexus through the spheno-maxillary fissure. The proptosis is increased by pressure upon the internal jugular vein of the same side. The intermittent exophthalmos occurs when the head is depressed, such as occurs in stooping, whereas enophthalmos follows when the head is in the erect position.

ENOPHTHALMOS.—In this condition the eyeball is displaced somewhat backwards in the orbit. It may be due to rapid absorption of fat which sometimes occurs in extreme emaciation. Sometimes it follows injury to the orbit, such as fracture of the floor, it may follow cicatrisation resulting from injury to the orbital connective tissue, and it is associated with paralysis of the sympathetic nerve, whereby the unstriped muscle in Tenon's capsule becomes paralysed.

GRAVES' DISEASE.—The changes, which occur in the thyroid gland in exophthalmic goitre, are those of an organ in active evolution, the cells lining the tubular spaces become columnar instead of remaining cubical, the lumen of the tubules is partly filled up by cubical cells, suggesting increased proliferation, much of the colloid material, which is normally found in the space, is absorbed and replaced by a more mucinous fluid. Thyroid extract, given in excess, produces symptoms not unlike those of Graves' disease. The symptoms of the disease appear to be due to a disturbed function of the thyroid gland, possibly there is a hypersecretion of some substances, which induce a form of auto-intoxication. Dr. A. E. Taylor writes as follows :—" In exophthalmic goitre we have a striking illustration of metabolic exaggeration. Associated with an excessive, or perverted, functionation of the thyroid body, the protein katabolism is exaggerated. There is a deficit of nitrogen, and strenuous forced feeding may not maintain the body weight. Despite increased heat dissipation, the body temperature is normal, or even increased. The exaggeration of the protein katabolism, while marked, is less extreme than the increased combustion of the carbohydrates and fats. The exaggeration of protein katabolism may represent simply an attempt at a compensation for the exaggerated carbonous metabolism, an aid in the heat production. Possibly the condition may resemble starvation, since the sugar and fats are so abnormally burned, their sparing power on the protein metabolism would be wanting, just as in sub-nutrition with a low carbohydrate ration. It may be possible that the exaggeration of the protein, and the greater exaggeration of the carbonous metabolism, are the common results of one cause. The thyroid body is now believed to possess an internal secretion that acts as an accelerator of protoplasmic combustions. The administration of thyroid preparation and an excessive activity of the thyroid body lead to further exaggerations in the combustions. In other words, the thyroid body is conceived to supply a substance that acts as a zymo-excitor to the fermentative reactions comprised in the protein and carbonous metabolisms."

Cases of Graves' disease should be looked upon as serious, and, so far as it is possible, the patient should be kept at absolute rest in bed, and should be allowed to see but few persons. An ice-bag, applied over the pre-cordial area, will relieve the palpitation, at the same time strophanthus, or digitalis, should be prescribed. Belladonna and sodium phosphate are useful remedies. In some cases, sodium phosphate alone, in doses of one drachm, given three times daily, and continued for six weeks or two months, has proved very beneficial.

The following combination may also be tried :—

℞	Tincturæ Belladonnæ - - -	♏viij.
	Tincturæ Strophanthi - -	♏vi.
	Aq. Chloroformi - - - ad	℥i.

Misce. Fiat Mistura.

Two tablespoonfuls to be taken three times daily.

If the patient is anæmic, irritable, and restless, the following medicine may be administered :—

℞	Ferri et Ammonii Citratis - -	gr. v.
	Potassii Bromidi - - -	gr. x.
	Spiritus Ammoniæ Aromatici - -	♏xx.
	Aq. - - - - ad	℥i.

Misce. Fiat Mistura.

Two tablespoonfuls to be taken twice daily.

If the diarrhœa is troublesome, Dr. Burney Yeo recommends the following remedy:—

℞	Tincturæ Cotonis	-	ʒi.
	Syrupi Zingiberis	-	ʒiv.
	Mucilaginis Acaciæ	-	ʒiv.
	Tincturæ Chloroformi Comp.	-	ʒiij.
	Spiritus Ammoniæ Aromatici	-	ʒij.
	Aq. Cinnam.	ad	℥vj.

Misce. Ft. Mist.

One tablespoonful to be taken for a dose when required.

CALOMEL INJECTIONS FOR SYPHILIS.—For the purpose of injection, 1 grain of calomel is suspended in 10 minims of liquid paraffin, and may be injected once a week for three weeks. These injections are, however, extremely painful, and are particularly liable to cause mercurial stomatitis and nodosities in the buttocks, from the inflammatory exudation around the deposit of mercury. These injections constitute the most powerful method of administering mercury, and should therefore be reserved for those urgent cases only, in which a very rapid effect is required, such as in cerebral and spinal syphilis. Fournier, however, recommends calomel injections in the following conditions:—Chronic palmar and plantar syphilides, depapillating glossitis, sclerosing glossitis, tertiary syphilis of the larynx and phagedæna. The advantages of the treatment of syphilis by injections are, that the dose of mercury may be readily controlled by the surgeon, and the treatment may be kept more private. The chief disadvantages are the pain which the patient suffers, and the formation of nodosities at the region of injection.

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REMARKS ON APPENDIX ABSCESS.[1]

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LOCALISED suppuration about the appendix, or perityphlitic abscess, is very common, far more common than people appreciate. In many, in fact we may say in most of the cases, the pus is small in amount, does not come to the surface, or require surgical assistance to release it, but discharges without observation through the appendix itself, or into the neighbouring bowel. If the appendix is subsequently removed, you may find a caseating centre near it, or a scar in the appendix or adjoining part of the cæcum. There will not have been any sudden fall of the temperature, or sudden relief of the pain, but the history is that the case gradually improved. In other instances, where there is a very evident swelling, this may rapidly subside, and, from a certain definite moment of relief, there is a rapid fall in the temperature leading to a quick convalescence. This may be temporarily interrupted by another rise of temperature and some return of the pain, but an improvement, similar to that before experienced, usually occurs, and recovery is not afterwards retarded.

No one can say, with absolute assurance, that any case of perityphlitic abscess will end in this way, hence there are very few instances in which this termination can be counted on with reasonable certainty, and a waiting policy advised. It must, however, be reckoned with as a possible occurrence, and considered in any case of the kind to which you may be called. It does not often occur in young subjects, but it may do so. Big, fat men, with much intestinal distension and a deeply-seated abscess, are undoubtedly very bad subjects for operation, and I have sometimes advised that in such it should be left to take this course as a definite plan of treatment, and have not regretted it.

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[1] *Abstract of Clinical Lecture.*

There are many dangers which are avoided by the early release of pus in cases of abscess of this nature.

1. The abscess, when it has become a large one, may make its way into the bladder, the large bowel, or the rectum.

2. It may extend to the pelvis and left side of the abdomen, or upwards on the right side into the hepatic region, or even into the pleura through the diaphragm.

3. It may rupture into the general peritoneal cavity.

4. It may cause general toxæmia.

5. It is more likely to be complicated by intestinal obstruction.

Hence it should be the rule to evacuate the pus as soon as possible.

The larger the abscess has become the greater the danger to the patient, and the longer his illness will be if he recovers. Do not wait until the skin is red and bulging, or even until it is possible to feel fluctuation; you must judge of the presence of pus by the history of the case, the temperature, and general symptoms, also by the amount of the pain, the extent of tenderness, and the stationary character or advance of the iliac swelling.

During the time you are waiting for symptoms, the abscess may discharge into the bowel, having become large whilst you have been "watching" it, but the opening will be quite inadequate to properly empty the cavity; recurring infection of the abscess cavity will take place with possible extension of the abscess and much septic absorption from it. Such abscesses may cause death from the exhaustion of hectic, due to prolonged suppuration, or from septicæmia. If recovery ensues, it will be after weeks of illness and suffering.

In one of our contributions to the literature of the diseases of the appendix, Mr. Corner and I have endeavoured to impress on the profession the importance of rectal examinations, and this examination is especially needed in cases in which the symptoms are indefinite and the local signs few. This applies most to cases in which the suppuration is in the pelvis. An abscess may be quite concealed in this part, unless such an examination is made, and it may assume large proportions before making its presence known. Mr. J. Grey Turner contributed an interesting paper on pelvic abscess to THE PRACTITIONER (1906, Vol. 1, p. 212), in which he also spoke strongly on this point, and writes: "I have seen two cases of well-developed abscess in the recto-vesical pouch, in which there was not a symptom to direct attention to that part, hence the need for routine examination." My experience of the "pelvic" appendix is, that its inflammation often gives rise to puzzling symptoms, local as well as general. The medical attendant "suspects appendicitis," but is not sure, because he has not examined the case per rectum, and it is on the result of this examination that the verdict depends. A concealed abscess is most commonly found in the pelvis; it may, however, be found in other places, especially to the outer side of the colon. It must be remembered that an abscess may be present, without any temperature, in cases of persisting swelling, which can be felt through the abdominal wall.

Such abscesses may burst into the urinary bladder, or cause cystitis by infection through the vesical wall. They may become isolated from the appendix, and present little evidence of their origin before they are opened.

When an abscess extends across to the other side of the pelvis, the amount of pus may be very considerable, and a second operation may be required some weeks after the first. The illness will necessarily be very trying.

The pleura may become infected, either by extension of the mischief in the abdomen by direct continuity of structure, or by the lymphatics.

The sudden onset of a pneumo-thorax has occasionally been the first evidence of this serious complication, and, when operation has been performed, the operator has been surprised to find a quantity of very offensive pus, which, from its odour, has undoubtedly come from the abdomen. There will usually be a history of vague abdominal symptoms, the nature of which was unsuspected. In all probability you will be told that the patient has had a "low typhoid," and was doing very well until the chest complication set in.

Should the abscess have discharged into the large bowel through an inadequate opening, the continued fever and vague abdominal symptoms may make the diagnosis difficult, and if hæmorrhage occurs from the bowel, the resemblance to typhoid fever will be very close. The source of the bleeding, in such cases, is mostly the opening up of some artery in the large intestine as a result of the sloughing of the intestinal wall.

Secondary hæmorrhage may take place from the wound after incision of an abscess, but is rarely seen.

A recent case, in Leopold Ward, illustrates this complication. A man, aged 45, who was suffering from locomotor ataxy, and some of the urinary symptoms of that disease, was admitted, under the care of Dr. Hector Mackenzie, on November 4, 1906, for an appendix abscess of fourteen days' duration. It was his first attack of appendix trouble. The patient was a big, fat man, and the abscess a very large one, containing much pus and gas. The condition of the patient was not good, and it was considered inadvisable to search for the appendix. A fæcal fistula formed in the gut five days after the opening of the abscess. On the 17th, retention of urine was present, after which cystitis became more serious. On the 20th, he had a rigor; on the 23rd, there was increased fæcal discharge, probably from extending sloughing of the gut. On the 28th, there was hæmorrhage from the wound, which was arrested by pressure. This recurred on December 1 and 3. The patient died, on December 9, from exhaustion, septicæmia, and pyelitis.

The hæmorrhage may come from the external wound as a result of imperfect securing of a vessel, and the ulceration caused by the too prolonged retention of a drainage tube, but, so far as can be ascertained, it has chiefly caused anxiety when an abscess has been "watched" and allowed to attain a large size before operation. The blood has then mostly come from the large bowel, and there has been sloughing of the wall of the gut. In the case described above, the abscess was very large, and the general condition of the patient most unsatisfactory, so that septic infection easily occurred after incision. I may add that, at the necropsy, there was a large opening in the cæcum, the result of this sloughing of the bowel, and that the appendix could not be found; it had probably sloughed and come away in the discharges from the wound.

Accidental Intraperitoneal Rupture of Abscess.—There are few accidents that give rise to more alarming symptoms than the rupture of an appendix abscess into the general peritoneal cavity. In some recent lectures[1] on the acute abdomen,

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[1] *Lancet*, 1906-7.

I gave examples of this catastrophe, and, since those lectures, we have had another case, which I am pleased to say was also saved by prompt operation. The sudden flooding of the peritoneal cavity, as the pus bursts the barrier which has hitherto limited its extent, naturally gives rise to much shock. There is a definite time in the history of the case when the patient became much worse. He had had a recognised appendicitis before that, perhaps he had been treated for it, but there was nothing to cause anxiety, until he was seized with a sudden pain when turning in bed, or when sitting up ten minutes or so before the doctor was sent for.

The last case of this kind, which was admitted, under the care of Dr. Hector Mackenzie, on May 18, 1906, was typical of the accident. It was that of a strongly-built man, aged 26. He stated that, for three years, he had suffered from indefinite abdominal pains; for a fortnight he had not been feeling well, but for five days there had been pain in the abdomen, on the right side, which had compelled him to remain in bed. At 9 o'clock on the morning of admission, he experienced severe pain in the abdomen, and became extremely ill, so that he was sent up to the hospital as soon as possible, where he arrived four hours afterwards. He was then looking very ill. He was lying on his right side with his legs slightly drawn up, his eyes were sunken, and his tongue very furred and dry. The abdomen was distended, and moved very badly with respiration. There was dulness in both flanks, with great tenderness on palpation, and general rigidity of the abdominal wall; this was extreme, but not more so in one part than in another. The liver dulness was not obliterated, and nothing was detected per rectum. T. 102°. P. 110.

At the operation, we found much pus dispersed throughout the peritoneum, the pelvis was full of it. Thorough lavage with warm sterilised saline was carried out, and the appendix removed. The board-like stiffening of the abdominal wall was difficult to overcome by the anæsthetic; it impeded the earlier part of the operation. Free drainage with tube and gauze was provided, and the usual remedies used to combat shock. The appendix was gangrenous and had perforated. It contained an ordinary fæcal concretion. Recovery was uneventful (except that five days after operation a little fæcal matter was seen in the discharge), and he left quite recovered on July 1, 1906.

This is the fifth case that has been treated here by me, during the past three years, in which a similar accident had occurred, and makes the fourth recovery as a result of prompt treatment; this complication must consequently occupy a definite weight in the arguments against procrastination in the treatment of these abscesses.

Of the more gradual escape of pus into the peritoneum, giving rise to very few symptoms when it occurs, such an event is apt to be overlooked until peritonitis is advanced, and it is too late to do much. The opening is not necessarily a very large one, and it may easily be made, yet the leakage may be considerable. A knowledge of this should, I think, prevent any surgeon from spending time, at the opening of an abscess, in looking for "pockets," however careful he may consider his investigation. The pockets will empty themselves in due course in the direction of least resistance. In the case of any large abscess of the kind under consideration, the necessary moving of the patient, and the administration of an anæsthetic, may cause a leakage when the surrounding barrier is not strong.

Toxœmia in localised Suppuration.—Another complication, which increased experience has caused me to regard as not unworthy of consideration, is that of general toxæmia arising from an abscess. It is commonly held that anything like a fatal poisoning in cases of unopened abscess is impossible, the limitation of the suppuration being a proof that no dangerous absorption need be feared. In the list of cases of appendix abscess supplied by me as a contribution to the discussion at the Medico-Chirurgical Society, there is one fatal case, in which the death was apparently due to acute yellow atrophy of the liver, which came on soon after incision of the abscess, but this was evidently an accidentally intercurrent disease. A case, with similar symptoms and ending, after removal of the appendix, has been recorded by Dr. Ballin, and two by Dr. Bayard Holmes. We occasionally see cases, however, in which the heart is affected beyond the usual, when the suppuration is evidently localised, and its action continues unduly rapid, when other symptoms have improved, and the abscess appears to be without change. There may be complaints also of faintness. You know how the heart becomes affected in cases of acute perforation with peritonitis, and how often patients die from heart failure when the abdominal symptoms have ceased to cause anxiety. The pulse may even be 120, in convalescing patients, weeks after the operation. A boy of 12, admitted February 23, 1907, to the wards, walked to the hospital for relief forty-eight hours after the commencement of symptoms of appendicitis. Two hours afterwards, when operation was performed, his pulse was 140 almost running, and he was in a condition of collapse, with pinched features, sunken eyes, cold and blue extremities, nearly moribund; it was a very difficult thing to restore him. The amount of purulent fluid in the abdomen was not large, but the effect of the absorption from an uninjured peritoneal surface of great extent was very striking. In an abscess, the surface is much more limited, and its powers of absorption are lessened by the deposit of lymph.

So far, I have only seen one case of fatal poisoning in this class of case, and that was in a child of 22 months. She was a heavy child for her age, subject to constipation, for which she was under treatment on October 7, 1906. Relief was obtained by purgatives on the 8th, but the following night was disturbed, and it was noticed next day that the legs were drawn up, and that she cried when the right leg was straightened. There was distinct resistance in the right iliac fossa, and slight tenderness, but she did not cry when it was examined. Temperature 101·2°. On the 10th, local signs increased. Temperature 102·6°. Child rather apathetic, with quick pulse. There was some sickness after milk. 11th, signs continue localised to right iliac fossa. Temperature 104°. Bowels acted after enema. 12th, vomiting came on about noon, "coffee grounds." Temperature rose to 105°. The child became remarkably apathetic, and had to be roused to take nourishment. During the afternoon the pulse became thready and feeble, and the child was evidently much worse. Vomiting of the same character continued. The abdominal condition remained localised. There was no general peritonitis; the whole of the abdomen, except in the iliac fossa, was soft, flaccid, and apparently normal. At 6 p.m. I saw the patient, and opened a localised appendix abscess. Saline solution was given per rectum, but consciousness did not return. The temperature continued high, vomiting continued, and general convulsions followed in quick succession until death, which ensued a few hours later.

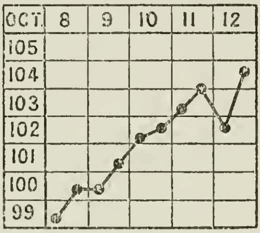

Fig. 1.—*Temperature chart of a case of fatal toxæmia with localised appendix suppuration.*

Here there can be no doubt that an acute toxæmia developed. It is true that no post-mortem examination was made, but the symptoms, the combination of the vomiting with gastric hæmorrhage and high temperature, were unmistakable.

Intestinal Obstruction.—Considering the intensity of the inflammation in many cases of appendicitis, it is really remarkable that we are not more frequently requested to operate for the relief of intestinal obstruction, resulting from the formation of bands and cicatricial contractions. Only about five per 1,000 of cases of intestinal obstruction, after all varieties of appendix inflammation, appear in tables furnished to the discussion at the Medico-Chirurgical Society (statistics given by Mr. Barling, St. Thomas's Hospital, the London, Guy's, and St. Bartholomew's), exclusive of cases due to volvulus. Of these the majority occurred in patients who had suffered from large collections of pus, and the symptoms developed late in the case, when there was a general contraction of the newly-formed fibrous tissue in the neighbourhood as the abscess cavity became smaller.

During the course of last year there were two examples of this complication.

1. A boy, aged 13, was admitted with an appendix abscess of six days' duration. It was his first attack. There was much pain and tension. Incision with drainage, on June 6,

1906. Ten days later the wound was closed, and he was given permission to return home, but when I was visiting the ward the day before that fixed for his departure, he was found to be complaining very much of pain in the abdomen. This was situated in the right side of the abdomen, and was associated with visible peristalsis of the small bowel. He had first complained of pain about 36 hours before. Abdominal exploration showed that a coil of small intestine was obstructed by the pressure of a firm fibrous band, which was divided. The appendix, which had been perforated at the tip, and was adherent to the old scar, was removed. There were many adhesions in the neighbourhood, some of which were separated. He made a good recovery.

2. A woman, aged 47, transferred from the care of Dr. Hector Mackenzie on June 17, 1906, for abscess of five days' duration. This was incised and drained. Thirteen days later she had symptoms of intestinal obstruction, which were found to be due to adhesion of a coil of small intestine to the neighbourhood of the abscess. Separation of this coil was easily effected, and there was no further interference with the progress of the case. The appendix, which was removed at this second operation, had to be taken away piecemeal. It was kinked and adherent, and near the base, on its mesenteric border, was the scar of an old perforation. It contained a little muco-pus. She left on August 18, 1906, having quite recovered.

There is still another way in which obstruction of the bowels is produced in consequence of appendicitis, and that is from annular cicatricial contraction of the wall of the gut, which has been involved. An example of this was given in the list of cases previously mentioned, also one of obstruction due to adhesions two months after evacuation of an appendix abscess. In the former of these, enteroplasty was unsuccessful; in the latter, separation of bowel with division of adhesions was successful in relieving the obstruction. In the latter the point of obstruction was where the process of suppuration was the longest time in subsiding after evacuation of a very large abscess. Obstruction, the result of intestinal paralysis, is seldom met with in other than the more acute cases associated with peritonitis of spreading nature.

Method of Opening.—The usual method of opening these abscesses is from the front through that part of the wall of the abdomen which is nearest the central point of the swelling, or the place at which the pus is pointing. Should, however, the abscess be in the middle line, it is better to make the incision to the right side, because the bladder is often carried up, and intervenes directly between the abdominal wall and the abscess. If the peritoneum is adherent you will find, as you get near to it, that there is some œdema of the abdominal wall, and pus may be found coming through along the line you have selected. When the peritoneum is not adherent, and your incision has opened the general cavity of the peritoneum, the swelling should be examined carefully with the finger, so as to satisfy yourself of its connections. Strips of gauze are placed so as to pack off the peritoneum, and isolate the track, along which the abscess is emptied by the finger passed into it from the surface of the iliac fossa. Rubber gloves should be worn, and a drainage tube introduced.

An extreme case showing the safety of this method of treatment may be mentioned.

The abscess, which was a small one, but caused much pain, was situated in front of the sacro-iliac synchondrosis, and the finger had to be passed a distance of 4 inches before the pus was reached ; yet there was no complication in the after treatment. Packing is quite as trustworthy as the suture of omentum to the wound.

The incision in the abdominal wall should always, when possible, be made with separation of the muscular and aponeurotic fibres, which should not be cut, otherwise a ventral hernia will certainly form later.

Occasionally, the abscess points in the lumbar region, and should be opened there.

I do not advise the making of a counter opening, except in large and neglected abscesses, as it is unnecessary. As regards syringing out the cavity at the operation, there is no reason why this should not be carefully done, with the view of bringing away any loose concretions, but any violent or prolonged syringing, with a view of getting rid of the offensive smell, is quite unnecessary and may be dangerous. It is, as a rule, unnecessary to syringe the wound during the after treatment, unless the abscess becomes secondarily infected.

This is an important thing to remember in the case of children, who are much upset at any prolongation of the dressing.

When the abscess points in the rectum it can be opened through that. This route should be always selected in preference to the vagina, the incision being made in the middle line, with due attention to the junction of the bladder and vagina. A cut through the mucous membrane and dilatation by means of forceps are required, with the insertion of a gauze plug, which will come away afterwards without difficulty, and will not require to be replaced.

Treatment of the Appendix.—The important question which you have to decide in all these cases is whether or no the appendix should be removed.

My own opinion is that it should not be removed as a routine practice. The opening of the abscess is not of itself in any way dangerous in the hands of a surgeon exercising ordinary care, whilst the search for an appendix in the wall of an abscess may result in serious trouble. The barrier shutting off the general peritoneal cavity may be broken down, the intestine may be torn, and, should that occur, the softened wall of the bowel may not hold the sutures placed in it, if the opening is found, which is by no means certain. The incision in the abdominal wall must be a somewhat large one to permit of a satisfactory search, so that a ventral hernia, with its inconveniences and dangers, will almost certainly ensue later.

To aid us in considering this subject, I have taken a series of 100 examples of this form of abscess, which have been under my personal observation and treatment at some time or other. In selecting the first 100 consecutive cases, we are more likely to gain an accurate idea of the dangers to which a patient with this variety of abscess is exposed. Of this series, 55 were males and 45 females. Of these, the majority were incised and drainage employed for a varying time, whilst in 13 the appendix was also removed at the operation. There were 10 which terminated fatally.

A.—*Simple Incision with Drainage.*

1. Exhaustion and tuberculosis of lung. M., æt. 15.
2. Cardiac seizure, ten days later. M., æt. 45.
3. Acute yellow atrophy of liver. F., æt. 28.

4. Peritonitis caused by damage to bowel in unsuccessful attempt to find appendix. M., æt. 25.

5. Abscess a very large one. Big man, æt. 45, with cystitis, and locomotor ataxy. During the treatment, sloughing of bowel and hæmorrhage from wound.

B.—*Incision, Removal of Appendix, Drainage.*

1. Cardiac seizure four days after operation. M., æt. 57.

2. Peritonitis, result of giving way of sutures in partial excision of cæcal wall. M., æt. 45.

There are in addition a number of fatal cases, which do not in any way help in deciding the question of treatment.

1. F., æt. 22 months, died from toxæmia due to simple abscess; incision and drainage after the onset of symptoms producing no apparent effect on the disease.

2. M., æt. 29, died from rupture into peritoneum, probably occurring at the time of simple incision.

3. M., æt. 15, spontaneous intra-peritoneal rupture, peritonitis; rupture occurred whilst lying in bed. Prompt operation unsuccessful in saving life.

What were the complications in the two classes?

1. When the abscess was simply opened and drained, fæcal fistula formed in four cases, two closed spontaneously, one died, one required excision of the appendix, in order to effect a cure. In two of these the original abscess was opened by other surgeons.

One of the fatal cases resulted from an earnest, but unsuccessful, attempt to find the appendix.

There were three cases of intestinal obstruction, all of which recovered.

2. When the appendix was removed at the time the abscess was opened, in two cases, an opening was accidentally made into the cæcum. In one of these, the sutures gave during vomiting after the anæsthetic, although three rows of silk sutures (No. 2) had been put in.

In a third, a case of sinus after removal during the opening of the abscess, at another hospital, he recovered from the sinus, but returned two years later, and died after operation for obstruction of the small intestine.

There are no cases of further extension of suppuration of pulmonary complications, or of thrombosis of vessels, but one patient developed suppurative parotitis.

It is somewhat difficult to obtain data, on which to compare the results of treatment by the two methods, (1) of removal of the appendix at the time when an abscess is opened, with (2) the result of simple incision of the abscess with drainage. Cases of appendix abscess differ very considerably, when they are brought under the notice of the surgeon, and the statistics which are available, even those given for the discussion at the Medico-Chirurgical Society, do not help us greatly.

A comparison of the tables of Guy's, St. George's, and the Middlesex Hospitals gives 196 cases of localised suppuration, in which the appendix was removed, with 23 deaths, and 185 cases of similar nature, where it was not removed, with 21 deaths. It is extremely probable that amongst the latter are included by far the most serious cases, those in which the abscess was exceptionally large, or the condition of the patient so bad as to contra-indicate any prolongation of the operation, for the complications during the after treatment, as remarked by Messrs. Boyd and Paget in their summary, were much more frequent when the appendix was not removed at the time. These statistics probably include all those in which the appendix could not be found at the operation, even after a prolonged search with its attendant risks. In fact, the statistics of the cases of non-removal of the appendix at the time necessarily include the worst cases, those in which complications of all kinds are more likely to be found under any method of treatment. The results, therefore, are more to the advantage of the second method of treatment, and this would appear yet more strongly, I feel convinced, did we know the causes of death in the 21 fatal cases in which no effort (or perhaps we should say no successful attempt) was made to remove the appendix.

The mortality of appendix abscess, from all causes, might therefore be put down as 10 per cent. in a series taken consecutively, but, when treated surgically from the first, it is much less than this, and should, I think, be under 5 per cent. In fact, it compares most favourably with the percentage mortality of empyæma. It will also be better, when taken from private sources as well as from hospital records, for the earlier the operation the more certain can we be of a good result.

MOVABLE KIDNEY.

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(*Concluded.*)

[With Plates XVIII.—XIX.]

SYMPTOMS OF MOVABLE KIDNEY.

IN a large number of cases, a movable kidney may exist, which never gives rise to any symptoms whatever. It is difficult to obtain accurate statistics on this point, but, in our opinion, it is the minority rather than the majority of individuals who possess this abnormality, for whom treatment, directed to the kidney, is ever required.

In such cases as present symptoms, the severity of these may exhibit every gradation from a dull aching pain in the back to the acutest paroxysms of renal pain. To the latter the name of Dietl's crisis is commonly applied.

For clinical purposes the anatomical classification, which we have adopted, is not very convenient. More useful will be found the division into acute and chronic cases, the former being still further divisible into two groups :—(*a*) Traumatic; (*b*) Acquired.

Dealing with the acute cases first, we find the symptoms are referable to the mechanical obstruction either of the renal vessels or ureter, or of both at the same time. This strangulation is undoubtedly the cause of the intense pain and shock which are always met with. Such a condition may be traumatic in origin, the onset of symptoms, in a patient previously in excellent health, following immediately upon some definite and severe injury to the loin. On the other hand, the acute attack may be superimposed upon a case of chronic movable kidney. In the latter case, the attacks, at first slight, soon become more and more severe, and occur at gradually decreasing intervals. Each paroxysm is usually initiated by some undue exertion, and these cases contrast with the traumatic ones, as in the latter the first attack is, as a rule, the most severe.

Of necessity, however, the acute cases, whether traumatic or acquired, have much in common in their symptomatology. We shall, however, have occasion to note certain differences, beyond those already referred to, which help to distinguish the two conditions. Newman (*Transactions of Clinical Society*, 1897) and Bruce Clark (*Medico-Chirurgical Trans.*, 1893) have recorded cases of the acute traumatic variety. We have thought it worth while to give a detailed account here of one of the former's cases, as it so well illustrates the condition under discussion.

Case.—R. C., marine engineer, æt. 40, came under observation in 1895, complaining of symptoms whose onset dated from an injury received on board ship, four years previously. At that time he had received a severe right lumbar strain, caused by a blow immediately under the right costal margin, owing to a sudden roll of the steamer whilst he was entering the man-hole of a boiler. He was immediately seized with severe pain in the right side, the duration of which was sufficient to prevent him from doing his work during the three weeks following his accident. Coincident with the attack of pain he noticed blood in his water, but the hæmaturia lasted for several days only, and then gradually disappeared. During the succeeding four years he was never quite free from aching posterior renal pain, and any undue exertion, or sudden movement of the body, at once brought on an attack of pain resembling right ureteric colic, accompanied by severe vomiting and faintness.

Complete rest always afforded marked relief to these symptoms, and, if active exercise was avoided, he seldom felt any ill effects from his accident.

In the quiescent intervals the urine was normal, but during the attacks it became concentrated, small in amount, and contained much blood. This was followed by the passage of a considerable quantity of pale dilute urine, as the pain subsided.

At the operation of nephrorrhaphy, which Dr. Newman performed, and which resulted in a complete relief of the symptoms, "it was found, on opening the adipose capsule, that the right kidney was not only movable, but rotated, so that even when the patient lay on his right side, the upper extremity of the organ pointed forwards. On carrying the fingers round the fibrous capsule, the fatty tissue was found to be only slightly adherent, and the pelvis was dilated to a moderate degree. The ureter was easily made out with the finger, and was found to be kinked over the renal vessels, and the kidney itself was observed to be enlarged, swollen, and engorged with venous blood. . . . When the fibrous capsule was incised, the soft cortical substance of the kidney pouted through the incision, and, on separating the capsule, free bleeding occurred."

There are several points of interest about such cases as this. In the first place, the majority, unlike the generality of movable kidneys, occur in men, who naturally are more exposed to accident than women. In the next place, the abdominal examination is often difficult owing to muscular development, or adiposity of the patient, a fact which may prevent palpation of the kidney. Also the kidney may not be freely movable, but may, as in this case, have simply undergone rotation around its shorter axis, and is therefore unlikely to be felt in the abdominal examination. The diagnosis is sometimes further obscured by the fact that no immediate symptoms, pointing directly to an injury to the kidney, may have followed the strain, which has produced the renal dislocation. In these circumstances, the diagnosis of renal stone is most likely to suggest itself. The points in favour of this view being (1) the paroxysmal character of the pain, which may very closely simulate that of ureteric colic; (2) the fact that it recurs from time to time; (3) the pain is invariably made worse by exertion, and relieved by rest; (4) the urine is likely to contain blood and albumen. In some cases, however, the quantity of urine passed is diminished to a considerable extent, a fact which will point rather to movable kidney with torsion symptoms than to stone.

At the same time, one must remember that this suppression or great diminution in the quantity of urine secreted, may occur with a calculus in the renal pelvis. The exact mechanism, by which the calculus anuria is brought about, is still an open question. The inhibition is probably caused reflexly. But, as Newman has pointed out, the most important aid to diagnosis is furnished by a microscopical examination of the centrifugalised urine. In such, the presence of blood-casts will point almost conclusively to some intra-renal condition rather than to hæmorrhage from the renal pelvis due to irritation from a stone. An X-ray examination should, however, always be made in doubtful cases, and will at times materially assist the diagnosis. In addition to the characteristics of the urine, just mentioned, Newman has drawn attention to the attitude which is adopted by many of the patients suffering from acute renal strangulation. No longer being able to lie down, they assume a sitting posture, and lean forwards ; the abdomen pressed against the flexed thighs, the knees being often clasped in the arms.

It is at times possible to differentiate clinically between the pathological conditions which are present in these acute attacks. In certain general particulars, of course, all present comparable symptoms. Thus, all are accompanied by paroxysms of lumbar and abdominal pain, which may become well-nigh intolerable, the patient may become collapsed, with small pulse, cold sweats, and anxious expression. Vomiting frequently occurs. The abdomen, rigid at first, especially on the affected side, and not moving well on respiration, may subsequently become distended. In fact, the clinical picture may suggest the possibility of rupture of some part of the gut. The urinary changes, however, afford valuable diagnostic information, and sometimes will also show whether it is the renal vessels, or the ureter, which are obstructed. If the ureter alone is constricted, a large tender swelling, the cystic nature of which can at times be determined, may be felt in the loin. This is, of course, a hydronephrotic sac, tensely distended with fluid. When the obstruction is relieved, a large amount of dilute urine, deficient in nitrogenous constituents, is passed within the space of ten to twenty minutes. This consists partly of the fluid previously pent up in the sac, partly of urine temporarily secreted at a very rapid rate by the damaged kidney. This fluid contains no albumen, tube casts, or blood, unless the obstruction has lasted for a considerable time. In the earlier attacks, the renal stasis, lasting only a comparatively short time, is not sufficient to produce much dilatation of the renal pelvis. If an operation is undertaken during a quiescent period, a somewhat pale and flabby kidney is found, showing little or no evidence of dilatation of the intra-renal portion of the pelvis, unless the kidney is actually opened up. As the attacks become more frequent, the kidney tissue gives way before the repeated strain thrown upon it. The cells lining the renal tubules undergo fatty degeneration, many of them are absorbed, and removed by the lymphatics, and gradually a hydronephrosis supervenes, in some instances so pronounced that only traces of renal parenchyma remain, spread out on the wall of the sac. Moreover, as the pelvic dilatation increases, the pelvic ureteric opening becomes more and more oblique, and a vicious circle is established, due not only to the oblique angle at which the ureter enters the pelvis, but also to the distended pelvis pressing on the ureter in much the same way as an aneurysm on the proximal portion of its artery. If one of these more advanced cases is operated on in the acute stage, a congested hydronephrotic sac is exposed, tensely distended with fluid, which spurts out with considerable force on incision of the sac. A case recorded by Bruce Clarke, in *Trans. Med. Chir. Soc.*, 1893, illustrates several of these points very clearly. We subjoin an abstract of the notes of this patient:—

G. P., a man æt. 22, came under treatment in 1890. He complained that, for the previous year, he had suffered at times from severe attacks of pain in the right loin, accompanied by vomiting, and sometimes by hæmaturia of the renal type. These attacks were always brought on by exertion (carpet lifting), lasted for about 24 hours, were always relieved by recumbency and rest, and were succeeded by the passage of a copious amount of dilute urine of low specific gravity. Mr. Bruce Clark operated during one of these attacks exposing the right kidney through an incision in the loin, and describes the appearances seen as follows:—

"The kidney was found without difficulty, and was at once seen to be considerably enlarged and tense. It was about the size of a large cocoanut, and was evidently filled with fluid.

An incision was made into it, and the fluid spurted out from its interior. No calculus could be detected. The walls were thinned out and contained little, if any, secreting substance. During the process of exploring the interior of the cavity with the finger, and whilst the outflow of urine through the incision was prevented by the finger, the fluid began to gradually escape down the ureter until the cyst was all but emptied. Whether this was due to the unkinking of the ureter or no, could not be made out with absolute certainty, but this seemed to be the most probable solution of the case."

We have gone rather fully into details on the subject of hydronephrosis, in order to emphasise the fact that this condition is likely to be met with in cases in which the ureter becomes kinked owing to rotation of the kidney.

In cases, in which the renal vessels are obstructed, the attacks, which result, present a somewhat similar clinical picture to those just described, but differ in two important respects : (1) No tumour is to be found in the loin, though the kidney often feels enlarged and swollen on palpation ; (2) The urine presents different features. We have seen that, in cases of ureteric obstruction, the urine in the early stages is passed in very small quantity, or may be suppressed, and that later a large amount of urine of low specific gravity and poor in nitrogenous constituents is secreted. Further, that it is unusual to find either blood, albumen, or tube casts in it. Where the renal vessels of one kidney are partially obstructed, the urine, though concentrated, does not seem so likely to be suppressed as in the former case, and, moreover, it contains blood, blood casts, granular and hyaline casts, and albumen. As the attack passes off, a moderately large quantity of urine of low specific gravity is passed, but containing the abnormal constituents mentioned. If palpated, the organ is found distinctly tender, and somewhat enlarged. Pressure causes a sickening pain resembling that felt when a testicle is unduly compressed. At operation, the organ is found to be enlarged, hyperæmic, with occasionally definite subcapsular hæmorrhages.

If both ureter and renal vessels are obstructed, the clinical picture will be a combination of the two types already described. It is interesting to note that, in a case recorded by Newman, after one of these severe attacks, the patient was found to be unduly excitable, and to suffer from persistent headache, and dimness of vision. Such symptoms suggest a possible toxæmic or uræmic condition, induced by the suppression of urine. In the case referred to, no urine was passed between 8 p.m. on February 12 and 7 a.m. on February 14. Now, although it is possible that such an acute disturbance in the urinary functions may produce toxæmic symptoms, in our opinion, the conditions, met with in chronic cases of movable kidney, are not the least likely to do so. We, therefore, regard as quite unwarrantable the suggestion that has been made, notably by Suckling, that, the neurasthenic symptoms, loss of weight, etc., which a certain number of such cases exhibit, may be regarded as toxæmic in nature. The urine in these chronic cases showing, as a rule, nothing abnormal whatever. It will be obvious from the description, which has been given of the acute cases, that, under certain conditions, great difficulty in diagnosis may arise. This is the more likely to occur when the patient is a young adult, in whom no previous symptoms of movable kidney have occurred, and in whom there has been no definite history of a possible traumatic cause. The following three cases are worth recording, as examples of such acute symptoms, occurring in young adults, and as illustrating the difficulties in diagnosis, to which they gave rise. They may be regarded as illustrating the acute acquired variety of movable kidney.

Case 1.—J. M., aged 23, had complained, since age of 15, of attacks of pain felt in the lumbar region posteriorly, but also in the abdomen about the umbilicus. These attacks were gradually becoming more severe. When 21 years of age, the pains became worse, and culminated in a very severe attack, brought on by jumping on to a railway platform from the line when hurrying to catch a train. The pain was accompanied by severe hæmaturia, bright and almost pure blood and clots being passed. The patient vomited. Two similar, but less severe attacks, occurred. The diagnosis of renal calculus was made, and a right lumbar exploration performed. The kidney was found freely movable, and a white band was noticed attached to the capsule, which itself was thickened. (This appearance is often to be seen in the capsules of movable kidneys.) Nothing else abnormal was detected with the kidney, even after it had been opened along its convex border, and the pelvis explored with the finger. The wound was closed, but the kidney was not fixed. After operation, the patient remained free from pain for three months (was the kidney, during this time adherent to the scar, subsequently becoming loose again ?). Then the attacks began again, but not so severely as before, and unaccompained by hæmaturia. The urine contained no albumen either. At the present time, attacks occur about every ten days, particularly if patient is tired, the pain, which lasts 18–24 hours, consists of intense aching in the right posterior renal angle, accompanied by tingling and a numb feeling down the outer and posterior aspect of the right leg. No immediate relief is obtained by rest, but, after some hours, this proves efficacious. At the time of the attack, the right kidney, which is movable, and slightly prolapsed, feels somewhat enlarged. There is increased frequency of micturition during the attacks. Physical examination, and the manipulation this entails, tend to bring on an attack.

Case 2.—F. M., æt. 24. Patient had experienced several severe attacks of anterior and posterior renal pain on the right side. The last attack was associated with transient hæmaturia and vomiting. Was admitted to hospital 18 hours after the onset. The urine contained a trace of albumen, and a considerable quantity of oxalate crystals, to which the urinary symptoms were attributed.

The abdomen was found uniformly distended and tympanitic. For three days subsequent to admission, no fæces, or flatus, were passed.

The patient's condition became critical. The diagnosis of intestinal obstruction was made, and laparotomy performed. The intestines were found congested, and very much distended, but no mechanical obstruction was discovered. The only actual abnormality found existed in the right kidney, which was movable, somewhat enlarged, and hard, the latter condition being due to the intense congestion which was also present. After operation, the patient's condition improved, but five days later a second subacute attack occurred, which, however, passed off in 24 hours. The patient eventually made a good recovery, though, from time to time, he still experiences slight attacks of lumbar pain. At the present time, the right kidney feels somewhat enlarged, is slightly prolapsed, and freely movable.

Case 3.—A. B., æt. 27, draper's assistant. Patient had complained, for six months, of severe epigastric pain, accompanied by vomiting of gastric and bile-stained material ; no hæmatemesis ; no obvious cause was found. The attacks, which had originally occurred once in three weeks, had lately become more numerous, and more severe. Between the attacks, which lasted about three days, the patient was in normal health. There were no urinary symptoms. Patient was losing weight, but was not emaciated.

On examination, an oval freely movable lump was felt (only occasionally) in the abdomen, 1 inch above and to the left of the umbilicus. Its nature was doubtful. The right kidney felt larger than normal, possessed increased respiratory excursion, and was freely movable on palpation.

The stomach capacity was two pints.

In spite of treatment by rest, diet, lavage, and drugs, the patient got worse, attacks occurring eventually every three days, and, at his own request, an exploratory laparotomy was performed.

The right kidney was found enlarged and freely movable. The pylorus was prolapsed, so that the stomach lay entirely to the left of the mid line. (The pylorus was the lump which had been occasionally felt on abdominal examination.) The stomach was not dilated, but the duodenum was much enlarged. Posterior gastro-jejunostomy was performed. The patient died on the seventh day from general peritonitis.

Post-mortem.—Position of stomach as above ; not dilated.

First and second parts of duodenum were enormously dilated, the circumference of the gut measuring 8 inches. The dilatation ending abruptly at the termination of the second part.

The operation anastomosis was quite sound.

The right kidney was large, weighed 9 ozs., was movable, but otherwise normal. The left kidney was very small, represented merely by a small knob of fibrous tissue. The left ureter was normal.

Microscopical examination of the pylorus was negative.

The case was thought to be one, in which a right movable kidney had caused constriction of the second part of the duodenum, by dragging on a peritoneal band passing from the kidney to the termination of the second part of the duodenum, and thus to be similar to Bramwell's case, already referred to. One of the most remarkable features of this case was the extreme dilatation of the duodenum in which the stomach had not shared. The explanation of this fact does not seem at all obvious.

Chronic Cases of Movable Kidney.—When the movable kidney gives rise to symptoms at all, the most constant of these, in our experience, is undoubtedly pain.

It is important to remember, however, that the degree of renal mobility bears no relation whatever to the pain complained of. In a patient, in whom the greatest range of movement we have ever seen existed, there was no pain whatever.

The sensory changes, which are associated with movable kidney, may be grouped into two classes:—(*a*) subjective; (*b*) objective. The former being by far the more numerous.

The appreciation of pain, as is well known, varies immensely with each individual, and largely depends on the presence or absence of the neurasthenic element.

By those who are not neurotic, the pain is usually described as of a dull aching character, felt, as a rule, in the posterior renal angle, and also anteriorly at the paracentral spot. It may, however, not remain limited to these areas, and is sometimes complained of lower in the back, although here great care must be taken to exclude any possible disease of the pelvic organs, especially when the pain is located at the base of the sacrum. Occasionally pain, undoubtedly due to movable kidney, is met with, extending down the thighs and back of the leg. Sometimes a sense of dragging or of weight is complained of.

As a rule, exertion or jolting from any cause makes the pain worse, rest usually relieves it. This is not, of course, the invariable rule, as a certain small percentage of patients complain that the pain is worse at night. In most cases of female patients, we have found that the pain is accentuated just before the menstrual period. This may be due to an increased congestion of the blood vessels, which is stated by some authorities to occur, or possibly the nervous system at such a time becomes more sensitive to all forms of stimuli. In neurotic and hysterical subjects the effect of this constant aching sensation may produce the most exaggerated description of their sufferings. No longer localised, the pain tends to become generalised, and this marks an important stage in the progress of such cases. The following extract from a letter from one of these patients gives a fairly accurate picture of the proportions the pain may assume:—

"Every bit of my body is ablaze with pain. It is like sparks all over me . . . then I get strung up to such a pitch, I cannot stand. It is all in my stomach, that is the trouble, and my back. Every bit of me is on the move. I feel at times I shall choke, and as though my skin was being torn off. Both my kidneys are loose, I feel they are the cause of my symptoms."

Such a mental condition, as indicated by this extract, can only be produced by a movable kidney in a patient of the most neuropathic disposition. Pain in the head is often complained of by these patients, and is due, in our opinion, either to constipation, which so frequently co-exists, or to dyspeptic troubles.

The effect of pregnancy is usually to alleviate the painful symptoms, no doubt by the mechanical support which the enlarging uterus affords to the prolapsed kidney.

Objective sensory changes are fairly frequent, but not very marked. In a number of patients, whom we have examined with special reference to this point, we have found a slight hyperæsthesia in the skin area corresponding to the tenth dorsal segment. The abdominal reflex is often brisker in such patients on the side of the affected kidney. We have never found any loss of sensation, such as has been described by some writers, in the distribution of the lumbar or sacral plexuses; the kidney itself, unless the seat of some pathological process, is quite painless on palpation. When this procedure causes pain, the explanation of this is usually to be found in the congested state of the organ, which follows the mechanical obstruction of the vessels or the ureter. This too is the most probable cause of the dull aching pain, of which the patients so frequently complain. But another factor in the production of this symptom is, no doubt, traction on the renal nerves, which is bound to occur in consequence of the elongation of the renal pedicle, so frequently met with in these cases.

Gastro-intestinal symptoms occur very constantly. Of these, constipation has been frequently referred to, and needs no further remark. With regard to the stomach, in the less severe cases one frequently meets with simple dyspepsia, instanced by pain after food, flatulence, and loss of appetite. But more serious disturbance than this occasionally occurs, notably dilatation of the stomach, which may be so pronounced as to indicate the possibility of pyloric cancer, an opinion to which the emaciation of the patient, obvious dilatation of the stomach, and characteristic vomiting lend much support. A fatal issue in a case of this kind has been recorded. Happily such extreme instances are rare indeed.

It is common knowledge that neurasthenia, in varying degrees, is frequently associated with movable kidney. The tendency of late has been rather too much inclined to the view that the complaints, which the patient makes about the kidney, are simply part of this neurotic condition. As a result, in many cases the fact that the patient has a movable kidney has been dismissed as trivial, and of no possible importance in the production of symptoms. This is surely a mistake. In many instances, the constant pain, slight though it may be, has in time produced the neurasthenia, and it is only to be expected that it should do so. Given a constant pain or ache, continued for a sufficient length of time, and who would not become more or less neurasthenic. If, in addition, the subject is one of a neuropathic stock, the result is sooner reached, and assumes more formidable aspects. Then it is that the pains complained of become generalised, and legion. When this has occurred, operative interference must be undertaken only with great caution. But, as we point out elsewhere, the mere fact of neurasthenia existing does not necessarily contra-indicate operation. The type of individual must, however, be carefully considered, and, in the class of cases just referred to, palliative measures, such as a rest cure, followed by the use of a belt, are, as a rule, preferable to operative interference.

Sometimes patients, the subjects of movable kidney, experience slight attacks of jaundice, and although this is never at all intense, the diagnosis of biliary obstruction, due to gall stones, or cholecystitis, has occasionally been made.

Although extremely rare, only one or two instances being on record, we must mention the occurrence of œdema of the leg, which may be caused by pressure of the kidney on the common iliac vein,[1] and of the still rarer occurrence of thrombosis of the inferior vena cava.[2]

DIAGNOSIS.

When examined during the quiescent period, of the commoner swellings for which a movable kidney may be mistaken, we might mention as the most frequent :—

(i) An extra lobe or lingiform process of the liver on the right side (Reidel's lobe) ;

(ii) A distended gall bladder (mucocele) ;

(iii) Carcinoma of the pylorus ;

(iv) A fæcal mass in the colon.

There are four objective signs usually given as characteristic of a renal swelling :—

(i) The presence of a tumour in the loin ;

(ii) The swelling can be grasped between the hands on bimanual examination, and can be pressed back on to the supporting hand placed behind the loin ;

(iii) Resonance on percussion ;

(iv) Movement on respiration.

Of these signs, the latter two are frequently absent in a swelling affecting the left kidney. In the case of a freely movable or floating kidney, one or all may be absent.

A kidney, floating in the umbilical region immediately beneath the abdominal wall, does not move on respiration, is dull on percussion, and may be returned into the renal fossa of its own side only with difficulty, or, perhaps, not at all.

Its identification usually depends upon the recognition of its characteristic form and shape, the fact of its exceedingly free mobility, and, should it slip back into the loin during palpation, the very characteristic sensation which it imparts to the examining fingers. In spite of this, however, it is quite easy to mistake a floating kidney of the right side, in a patient with rigid abdominal muscles, and associated with marked gastric symptoms, for a localised movable growth of the pylorus.

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[1] Landau.

[2] Girard : *Journal hebdomedaire de progrès des Sciences médicales*, 1836, iv.

We, ourselves, have seen two cases in women, between the ages of 35–45 years, in both of which there was about a six months' history of rapidly increasing epigastric pain and vomiting after food, associated with pronounced wasting, and an ill-defined movable lump in the abdomen, lying somewhat to the left of the right paracentral point. In each case, an exploratory laparotomy was performed, and showed the right kidney floating with its hilum directed upwards in the position of the supposed growth.

With regard to a Reidel's lobe, or hydrops of the gall bladder, matters are rendered rather more difficult by the fact that the former is often associated with a right movable kidney.

A Reidel's lobe gives dulness directly continuous with the hepatic dulness, has a lower sharp margin, and its superficial position, taken in conjunction with its free respiratory excursion, usually serves to distinguish it from a floating kidney. The latter, when lying immediately beneath the anterior abdominal wall, unless actually adherent to the inferior surface of the liver, an unusual occurrence, shows no change of position even on deep inspiration.

Rovsing, of Copenhagen, has recorded an interesting case (*see* p. 646, THE PRACTITIONER, November 1907),[1] in which a large hard tumour in the right renal region, associated with marked wasting, and attacks of renal hæmaturia on exertion, was diagnosed as a malignant tumour of the right kidney. A right lumbar incision showed a much displaced right kidney, which was adherent to the posterior surface of the right lobe of the liver, and the tumour felt consisted of the liver plus kidney.

A distended gall-bladder, which can be pressed backwards into the loin, is more likely to give rise to an error in diagnosis. A mucocele, however, which has attained sufficient size to give this sign, would be mistaken for a hydronephrotic movable kidney, and careful consideration of the symptoms, combined with the fact that there is no band of resonance between the tumour and the liver, ought to be sufficient to direct the attention to the gall-bladder in most instances. It must be remembered that, in obstruction of the cystic duct alone, jaundice is absent, and that the jaundice of movable kidney, coming on after an acute attack of pain, is of so slight and transient a nature, that, taken in conjunction with more definite urinary symptoms, it will allow, as a rule, a correct interpretation of the case to be made.

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[1] *Brit. Med. Journ.*, Part II., pp. 15–47, 1898.

A case seen by one of us some years ago presented several interesting points in diagnosis :—

A middle-aged woman gave the history that, for the previous 12 months, she had suffered from repeated acute attacks of abdominal pain and vomiting. The attacks were usually brought on by some form of undue exertion, and occurred as frequently as once every 2 or 3 weeks. During the intervals, the patient was quite free from pain except for slight lumbar aching. The urine contained a trace of albumen, but no casts, and there was slightly increased frequency of micturition, most marked in the daytime, when the patient was up and about. Immediately above the umbilicus was a slightly tender, fixed abdominal swelling of reniform shape.

The question of a floating kidney, which had subsequently contracted adhesions, was discussed, but an abdominal exploration showed an even more unusual condition. A peptic ulcer, situated on the anterior surface of the stomach, had leaked, and resulted in the formation of a small pocket of pus, which had been completely shut off by a mass of indurated omentum and adhesions, forming the swelling mistaken for the kidney. Occasional traction from time to time on these adhesions had no doubt produced the sudden attacks of pain and vomiting.

DIAGNOSIS IN THE ACUTE STAGE.

If the patient is seen within an hour or an hour and a half of the onset of the attack, when the abdominal walls are lax and soft, there is little difficulty, as a rule, in identifying the condition as being of renal origin. In the loin an enlarged exceedingly tender kidney, palpation of which may produce nausea or actual vomiting, can be felt, and this, taken in conjunction with the characteristic renal pain, and perhaps intense frequency of micturition and strangury, will, in most instances, point to the true nature of the case. The greatest difficulty will arise in the diagnosis from a commoner condition, the ureteric colic due to a renal calculus, and, with regard to this, Newman has pointed out the important significance of blood tube casts in the urine. The presence of these casts, which, however, will only be found as the attack subsides, points to a lesion in the renal parenchyma from an obstructed renal vein rather than to hæmorrhage from a loose stone in the pelvis of the kidney.

Further, if the patient was known to have a movable kidney previous to the attack under consideration, this would certainly assist in the diagnosis, although, as we have already pointed out, stone formation may occur in a movable kidney.

During the subsequent quiescent period, careful skiagraphy of the renal regions would demonstrate the absence of stone, and this examination can be further supplemented by a screen examination of the kidney at the time of operation. If, at this time, any uncertainty arises, it is safer to lay the kidney open along its convex border, or by an incision into its pelvis, and thoroughly explore by inserting the finger. A stone impacted in the ureter can be excluded by passing a bougie down its length into the bladder.

If the patient is first seen a few hours after the onset of the attack, the diagnosis may be much more difficult. At this time, there is frequently either a local, or a general condition of tympanites. The abdomen moves poorly, is uniformly distended and tender, feels rigid, and closely resembles the condition of affairs seen in a commencing general peritonitis due to some perforation of the gut. Perhaps a ruptured or leaking duodenal ulcer simulates the condition most closely. But, in "renal dislocation," there is usually slight pyrexia, the temperature often rising to 100·5° or 101°, whilst, in ruptured gut, the patient is in a condition of profound shock showing a subnormal temperature.

As the attack of renal distension passes off, usually within 4–24 hours, although it may last for several days, the abdominal muscles relax, and an abnormally movable kidney will be felt, curiously enough becoming in a short time hardly at all tender on palpation.

Acute intestinal obstruction may be also simulated, but here again the marked vesical symptoms will usually indicate that the true site of the lesion is situated in some part of the urinary tract.

We have seen several cases, with well-marked movable kidneys on the right side, showing the scars of previous appendicectomy operations, which had in no way relieved the patient.

Perhaps the most charitable view to take would be to adopt Edebohl's assumption of the close relationship which he supposes exists between mobility of the kidneys and appendicitis.

TREATMENT OF MOVABLE KIDNEY.

There is undoubtedly a large number of cases of movable kidney, which never give rise to any symptoms. The condition has often been discovered in the course of a routine examination, when nothing has occurred to direct any special attention to the organ. Such cases require no treatment, and the prudent man will keep his discovery to himself. For if a patient once suspects there is "something wrong" inside the abdomen, the knowledge may lead to a whole host of aches and pains, which the patient will be sure to put to the credit of the kidney, and which, in other circumstances, would have passed unnoticed, or been dismissed as trivial.

But apart from the effect on the patient, which the knowledge of a movable kidney may produce, the physician himself must beware lest he attributes any rather obscure symptoms to the one tangible sign, which he may have been able to establish. Landau draws attention to this point, and his words are worth quoting:—

"Pleased with his discovery," he says, "the physician may impute all subsequent symptoms to the movable kidney."

However, in a large number of cases, treatment is imperatively called for, and the question arises as to whether palliative measures will suffice, or whether the more radical surgical treatment should be adopted. With regard to the operation of renal fixation, much has been written during the last few years. The symptoms, for which such treatment has been advised, have been so numerous, that it has become the fashion, among a certain proportion of the medical profession, to decry all surgical interference in cases of movable kidney. Such an expression of opinion is but the natural sequence to, and a reaction against, the host of indiscriminate writing, with which the literature of the subject teems. So far as one can judge, a certain number of surgeons seem to have regarded the operation of nephrorraphy as a panacea for the majority of those minor ills, to which all flesh is heir, and it is only fair to state that they have been encouraged in this view by certain of their medical confrères. In a recent monograph on the subject, the writer attributes almost anything, from insanity and epilepsy to appendicitis, to the malign effect of a movable kidney !

We are, however, convinced not only of the desirability, but also of the necessity, of operative interference in a certain class of case. The cases for operation, however, require careful selection, otherwise disappointment will occur to both patient and surgeon alike.

No one can afford to disregard the gradual impairment and eventual loss of function, which have been clearly demonstrated, in an organ of such vital importance as the kidney. The operation itself is associated with a minutely small death rate, and the complications, following operation by a skilled surgeon, are few. We quite recognise that a low mortality is no logical reason for recommending operation, but we are of the opinion that the results, obtained by nephrorraphy, compare very favourably with those undertaken for the radical cure of hernia, a condition which may not inappropriately be compared with that of movable kidney.

On the other hand, so long as dyspepsia, vague feelings ot epigastric and lumbar pain, and constipation, occurring in a patient in whom the lower pole of the right kidney is palpable on inspiration, are regarded as sufficient grounds for the performance of nephropexy, so long will failure and discredit fall upon the operation.

According to Treves, the majority of cases, which show symptoms undoubtedly caused by movable kidney, do not require operation. One class of case, however, namely, that associated with Dietl's crises, should, in his opinion, be treated surgically. We would extend the limit of operation cases somewhat beyond this rather confined margin. In our opinion, the cases in which operation is advisable may be divided into four classes:—

(1) All cases showing acute exacerbations of anterior renal pain, often accompanied by vomiting and occasionally by hæmaturia.

(2) Cases showing evidence of pathological changes in the kidney. Such changes usually being—

- (*a*) Hydronephrosis (this is usually a sequel to Class 1);
- (*b*) Albuminuria—often transient and coming on after some unusually severe exertion;
- (*c*) The presence of casts;
- (*d*) Occasional increased frequency of micturition, with or without polyuria.

  Quite apart from the passage of an increased amount of urine, renal irritation often gives rise to increased frequency, which is so often erroneously looked upon as a purely vesical symptom.

(3) Cases in which the kidney is mechanically causing changes in other viscera, *e.g.*:—

- (*a*) Stomach or duodenum, as illustrated by gastric dilatation; or
- (*b*) Biliary passages. (These are, however, rarely affected.)

(4) Cases of severe aching, posterior renal pain, in which an efficient truss has failed to relieve the symptoms.

The following conditions in our opinion contra-indicate operation:—

(1) Movable kidney associated with Glénard's disease.

(2) Marked prolapse of the genital organs in the female.

(3) A certain type of neurosis in the patient. As we have already stated, in considering the symptoms associated with movable kidney, the patient is often neurasthenic.

But this neurasthenic condition does not cause the kidney to become unduly mobile, and certainly, in a considerable number of cases, the neurasthenia seems to be the result of the kidney condition. Accordingly, we do not regard the presence of neurasthenia as a contra-indication to operation, provided that any of these conditions, which we think point to operative treatment, are present. The important point is to recognise the patient, usually of a neuropathic stock, who has all her life suffered from something or other. In such an one, the knowledge that she possesses a movable kidney has, in all probability, produced the overwhelming list of aches and pains, often tabulated on a sheet of paper, which she inflicts on all and sundry who may be compelled to listen to her. Operation on such a patient is doomed to failure. If there is no imperative indication for operation, or if the patient will not undergo such treatment, we must consider what means are available for alleviating her condition. In the first place, one must consider the type of patient with whom one has to deal. In a large majority of cases, the patient will be found to belong to a definite type. Often tall, thin, and with her vital energies depressed, she has probably been in the habit of overtaxing her strength, or, in popular language, "doing too much." She is tired out. To such a patient, the symptoms of her disease must often bear an exaggerated aspect, for her resistance to abnormal sensations, however slight, is lowered. In such a case, a thorough rest is clearly indicated, and, to make the rest a real one, the patient should, if possible, leave her home surroundings, and retire to bed for a month at least. At the same time, she should be fed liberally, and her bowels carefully regulated, with the object of increasing her weight and general nutrition, an end that may be materially assisted by a course of general massage. Whilst such treatment cannot fix an abnormally mobile kidney, it is certain to improve her general health and resistance materially, and, in almost all the cases, the aches and pains will have disappeared long before the "rest cure" is completed. However, the patient cannot remain under these conditions for an indefinite period, and, with the resumption of an active life, the symptoms may return, perhaps in small degree at first, but tending to become more accentuated as time goes on. What can be done to prevent this? If the kidney is not to be fixed by operation, some effort must be made to keep it in its position by a mechanical contrivance. The majority of belts and trusses, designed for this purpose, are admittedly unsatisfactory. There is, however, one notable exception to this. The apparatus to which we refer is one which has been evolved, after many trials, by Ernst and Son. This instrument, which is illustrated in the accompanying wood-cut, has proved very satisfactory. Its advantages are that it combines efficiency with lightness (weight 6 oz.), and is therefore not objected to by the patient, as are some of the more cumbersome appliances which have been recommended. This truss attains its object by means of two springs, a main and lever spring. The former, which exerts a direct backward pressure, is attached to a centre pressure plate, taking its bearings in the lumbar region, carefully avoiding all pressure on the spinous processes of the vertebræ. This spring passes some little distance above the crest of the ilium, and dips down the abdomen well below the limit of the movement of the kidney. To the distal end of this (the main) spring is fixed a lever spring, which is attached to the lower border of the kidney plate, giving a direct upward and outward lift. The apparatus is attached by a small body and understrap, and does not show in the dress or make any alteration in the figure.

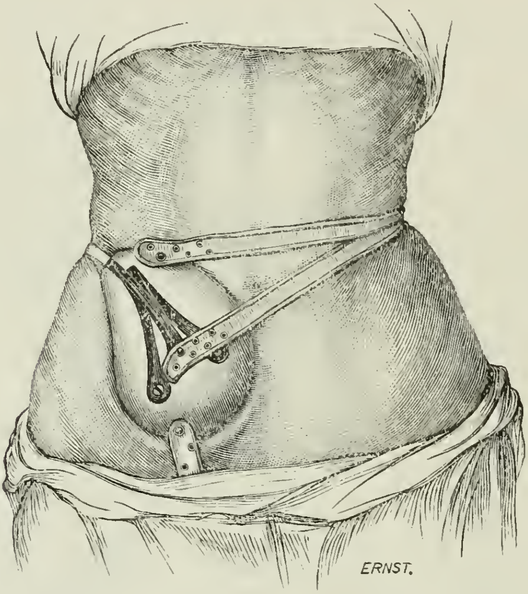

Fig. 7.

It must be remembered that many of these patients are thin, and are extremely intolerant of any points of pressure; they therefore require most careful fitting, and must be prepared to devote several sittings to the accomplishment of this object.

The truss is only worn during the daytime, and is applied by the patient herself before rising in the morning. She lies in the recumbent position, with her pelvis raised on a pillow, and then, having gripped the affected loin firmly with the hand of the same side, the thumb in front and the fingers behind, to assure herself that the kidney is in position, she applies the truss. If she has not got the kidney into its proper position before the instrument is applied, she is at once warned of the fact by the pain and discomfort which ensue.

Treves,[1] who has used this truss for all cases of movable kidney except those associated with torsion symptoms, speaks most highly of its utility. He states that, in 95 per cent. of the cases, in which it has been employed, it has proved successful. He also states that, in a large proportion of cases, the truss may be given up after 18 months to 2 years.

Champneys also testifies as to its efficacy in certain cases, and finds it most useful in patients suffering from some pelvic lesion, such as prolapsus uteri, for whom nephrorrhaphy is so often unsatisfactory.

Perhaps a very accurately fitting abdominal belt, stiffened with whalebone, is more suitable for patients with very lax abdominal walls and marked enteroptosis. It should be fixed on to the corsets above, and carried well down over the iliac crests below to prevent it from slipping upwards.

TREATMENT DURING THE ACUTE STAGE.

During the paroxysm or crisis, the pain is of so severe a nature, and the shock often so pronounced, that the patient will of necessity assume a position of recumbency.

The pain must be relieved by the application of hot flannels to the affected loin, combined with a hypodermic injection of morphia if necessary ; a purge may be administered, and the tympanites treated by the injection of hot turpentine enemata. This treatment will, as a rule, make the patient very much more comfortable, and, in the majority of cases, under this simple *régime*, the attack will pass off in from 4–5 hours. Bruce Clark (*Trans. Chir. Soc.*, 1902) has, however, pointed out that the kidney may remain permanently displaced, and complete atrophy ensue.

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[1] The Practitioner, January 1905.

Occasionally, however, it has been noticed that mere bimanual examination of the loin has resulted in the kidney slipping back into the renal fossa, and a complete subsidence of all symptoms quickly followed. The organ, however, is, as a rule, so tender that direct manipulation with this object in view is greatly resented by the patient, or rendered impossible by the pain to which it gives rise.

We think that, in such cases, an anæsthetic should be administered, and the relaxation of the abdominal muscles so produced, combined with a little bimanual manipulation, will often, in some way, alter the relations of the kidney, and allow it to slip from between the hands back into its proper position in the loin. This purpose is better accomplished by placing the patient in the Trendelenburg position.

In any case, it is a method certainly worth trying, as the acute distension of the renal pelvis with urine, and the extravasation of blood into the parenchyma of the organ, which accompany such cases of renal strangulation, must produce permanent ill effects if allowed to continue for any length of time.

If the methods indicated do not prove successful, and the symptoms remain unabated, after a period of 5 or 6 hours has elapsed, we think that the question of immediate lumbar exploration must be given careful consideration, and, if decided upon, that this should be combined with nephrorrhaphy, although the engorged state of the kidney would render proper renal fixation a somewhat more difficult matter at this stage. The subcapsular hæmorrhages, occasionally seen during operation in an acute case, render abundant evidence of the severity of the local condition, and an explanation of the intense pain caused by the great intra-capsular pressure.

OPERATIVE TREATMENT.

Nephrorrhaphy.—If, from a careful consideration of the points mentioned above, an operation has been decided upon, there are two objects which must be attained in order to secure a successful result:—

(*a*) Replacement of the kidney in a suitable position in the loin;

(*b*) Efficient fixation in that position.

No part of the right kidney, which, in the great majority of cases, is the organ affected, normally lies above the level of the twelfth rib, as we have pointed out in the anatomical section. The latter merely passes downwards and outwards in relation to the upper pole and superior part of the convex border of the kidney. Therefore, in ordinary circumstances, it must be fixed at this level.

If it is placed too far up in the hypochondrium, it will soon be pressed downwards and loosened by the liver; and, on the other hand, if it is fixed too low, the pressure of the corsets at the waist line will be above the greatest antero-posterior diameter of the kidney, and will not only cause pain by direct pressure, but will quickly force down the kidney and loosen it from its artificial attachments.

But although we have given the level at which the kidney usually lies, this is a point which is subject to great variation in different individuals, and every case must, therefore, be judged on its own merits at the time of operation.

If the liver is slightly enlarged and prolapsed, it is useless to attempt to force the kidney up to what may be regarded as its normal level, because no amount of suturing will fix it there permanently. Again, if the kidney itself is enlarged, the same objection will hold good. It must be placed as high as the space in the lateral vertebral recess at the disposal of the surgeon will allow, care being taken that no tension on the renal pedicle is produced, or considerable pain for several months after operation will ensue. It must also be remembered that the hilum of the kidney is directed considerably forwards as well as inwards, and therefore that the posterior renal surface must not be placed quite flatly on the posterior abdominal parietes, the area of fixation being situated on the outer part of the posterior surface, and the posterior portion of the rounded convex border of the kidney.

Although great numbers of operations for the radical cure of movable kidney have been proposed and practised, they differ not so much in principle as in the details of technique, and may all be placed in one of two great classes:—

(A) Those seeking to fix the kidney by the production of a process of granulation and suppuration, which results in the formation of much perinephric scarring and cicatrisation;

(B) Fixation by suture,
    (i) Simple suture.
    (ii) Partial decapsulation of the kidney in addition to suture.

The former method is usually accomplished by slinging the kidney more or less into position by means of large gauze bands (Senn's operation). In one method it is proposed to paint the tunica propria with Acid Carbol. Liquefact. in addition (Carwardine's operation).

The gauze bands are removed at the end of three weeks, and the patient is kept in the recumbent position for about one month in all.

That anyone can knowingly produce suppuration in the loose fascial planes around such an important organ as the kidney is almost incredible, in these days of modern aseptic surgery. One would have thought that methods of this description would long ago have been relegated to the present position of such barbarous procedures as the injection methods for the radical cure of recurrent hydrocele.

In the operation of simple suture, the kidney having been exposed from the loin, three or more sutures are passed through its posterior surface without reflection of the capsule. Each suture is buried for a length of about $\frac{3}{4}$ inch within the kidney substance, and penetrates about $\frac{1}{2}$ inch into the thickness of the organ. These sutures are passed through the cut edges of the deeper layer of muscles (Int. oblique and transversalis) and tied sufficiently tightly to ensure firm apposition of the renal surface and the posterior abdominal wall.

Various suturing materials are used, and of these kangaroo tendon, silk, chromicised catgut, and the patient's own tendons may be mentioned. Kangaroo tendon possesses many advantages, and proves the most satisfactory in actual practice, lasting as it does for two or three years, or even longer, and producing little if any irritation of the surrounding tissues. Silk, although its simple and easy sterilisation by boiling is a great advantage, is not suitable for passing deeply into the renal parenchyma.

Unless fairly thick strands (No. 2 or 3) are used, there is a great tendency for them to cut through the renal parenchyma as the sutures are tightened. Indeed, in some unusually friable kidneys, probably in the earlier stages of patchy interstitial nephritis, no hold at all, even with catgut, can be obtained with deep sutures.

Moreover, the employment of silk sutures in this way is frequently followed by deep suppuration.

Troublesome sinuses are common complications of this accident, and these are extremely difficult to close. In some cases, it is necessary to reopen the wound, and remove the infected sutures at a later date. The kidney is found surrounded by dense fibrous tissue, and shows much scarring and puckering of its surface, and is usually firmly anchored in position. The sutures themselves are often embedded in the renal substance, and impregnated with lime salts.

The suppuration often comes on about the fifth or sixth day, is usually a staphylococcic infection, and is characterised by much lumbar pain, and a slow gradual rise of temperature and pulse rate, with bulging of the affected loin. Sometimes the wound, which has healed originally by first intention, may break open again many months after the initial procedure, and a sinus persist until the offending ligature is discharged.

If silk is used, it is perhaps a better plan to pass it through all the layers of the lumbar *parietes*, and to bring it out through the margins of the skin incision. It can then be removed in about 10 to 14 days, but, in our experience, suture for this period of time only is certainly not sufficient, the adhesions formed not being strong enough at this date to resist any sudden strain or movement of the patient without the additional support of the sutures.

Chromicised catgut, although in other ways very satisfactory, is not resistant enough for this purpose.

Vulliet, of Geneva, used tendons of the Erector Spinæ freed at one extremity through a second lumbar incision. This method lengthens the time of operation, is somewhat complicated in its performance, causes unnecessary bruising of the tissues, and possesses no manifest advantages over the use of kangaroo tendon.

In the second variety of the suturing method, in which partial decapsulation is employed in addition, the essential part of the procedure is the placing of a bared area of renal cortex of variable extent in direct contact with the fasciæ and muscles of the posterior abdominal wall, and the fixing of the kidney in that position by some form of suturing, until such time as firm adhesion has had time to result.

The sutures may be passed through the capsule of the kidney only, or may include a small piece of the renal cortex.

Arbuthnot Lane divides the reflected capsule into a number of small ribbons, to each of which a ligature is tied, and the latter are then passed through the deeper muscular layers of the incision and secured.

Fullerton has described a more complicated method, in which a flap of the tunica propria is thrown upwards, passed over the external arcuate ligament, and fixed, additional sutures uniting the capsule at the margins of the denuded surface to the lumbar fascia laterally.

We would agree with Goelet in condemning the use of suspension sutures, passed either through the periosteum of, or actually round the last rib. There is always an appreciable risk of wounding the lower margin of the pleural sac by their use, or even of including the subcostal nerve in their grasp, and by them one attains nothing that cannot be secured by simpler and safer methods.

The kidney will be firmly fixed by newly formed adhesions, and, if the latter are not present, no number of suspension sutures will take their place. The argument usually brought forward in their favour is that their use renders a higher position of the kidney possible, but this we entirely fail to see.

We have compared the results of these two methods by operations done upon cats and careful post-mortem examinations made at intervals of 1 to 16 weeks after operation. In these subjects, there was no doubt that the partial decapsulation method was far superior to that of simple suture, nor do we think that any greater degree of permanent damage was done to the affected kidney by the former operation.

In the simple method, three silk sutures (No. 1) were passed deeply through the renal cortex ; one at the junction of the upper with the second quarter, one through the centre, and one through the junction of the upper $\frac{3}{4}$ with the lowest $\frac{1}{4}$ of the posterior surface of the kidney. All intervening fat having

PLATE XVIII.

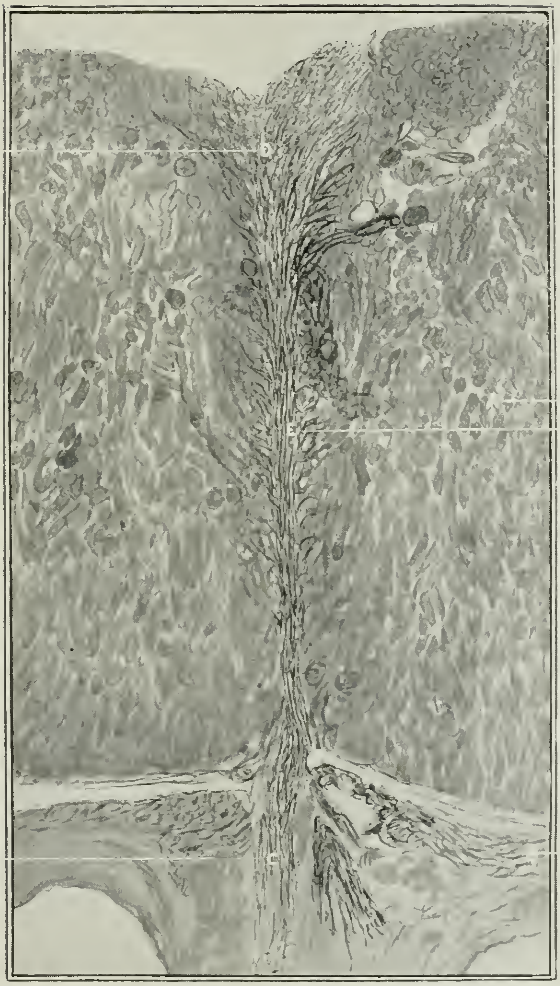

Fig. 8.—*Semi-diagrammatic drawing of section to show imperfect fixation of cat's kidney six weeks' after operation of simple suture.*

A. *Renal cortex.* B. *Lumbar parietes.* C. *Spike of fibrous tissue.*
D. *Fan-shaped expansion of fibrous tissue.*
E. *Clear spaces representing position of degenerated tubules.*

Plate XIX.

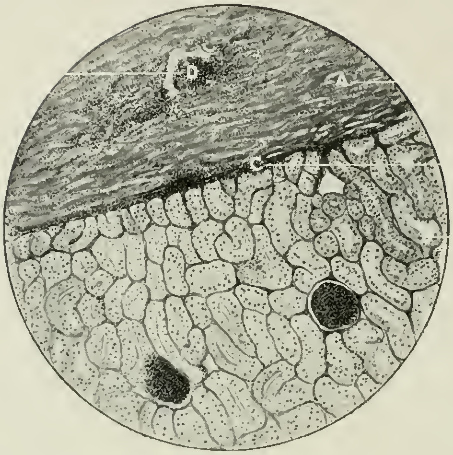

Fig. 9.—*Drawing of microscopic section to illustrate firm fixation of a cat's kidney six weeks after the operation of partial decapsulation and suture. (Zeiss.* $\frac{1}{6}$ *in. Hæmalum and Eosin.)*

A. *Lumbar parietes.* B. *Renal cortex.* C. *Round-celled infiltration.* D. *Round cells in neighbourhood of silk suture.*

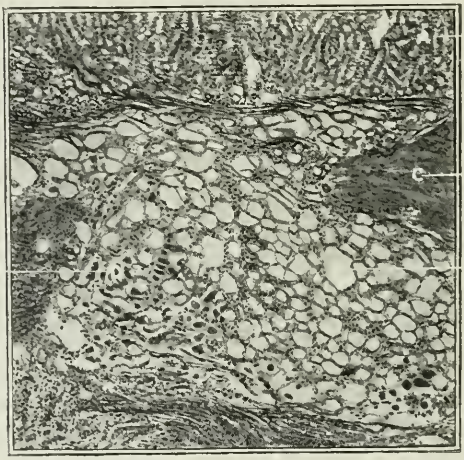

Fig. 10.—*Drawing of microscopic section to show failure of fixation due to imperfect resection of Capsula adiposa. Cat's kidney six weeks after operation. (Magnification* $\frac{2}{3}$ *in. Stained by Pappenheim's method.)*

A. *Renal cortex.* B. *Capsula adiposa.* C. *Lumbar parietes.* D. *Giant cells.*

been removed as completely as possible, each end of the sutures was passed through the internal oblique and transversalis muscles of its corresponding side of the incision, a short distance from their cut margins. This deeper layer of muscles was then brought together by fine silk (size oo), and, when this had been done, the deep kidney sutures were tied, and the superficial layers of the wound closed by interrupted sutures.

Fair macroscopic union was obtained in about six weeks, but, on cutting sections of the affected kidneys and their attached muscles, it was seen that adhesions had resulted only at the sites of suture, and that the intervening portions of renal surface, lying in direct contact with muscle and fascia, showed no signs of fibrous adhesion or granulation tissue. At the points of suture, bands of well-formed fibrous tissue were found penetrating deeply into the renal cortex and intermediate zone of the kidney. At first narrow and well defined, these bands, as they were traced inwards, were found to spread out into somewhat fan-shaped expansions, and the point at which the silk sutures actually pierced the renal tissues was reached, a certain amount of small round-celled infiltration became evident.

Within this zone of fibrous tissue could be seen the remains of the crushed urinary tubules, the epithelium either completely shed or remaining in various stages of degeneration, here and there rounded spaces alone representing the previous position of tubules. The portion of renal tissue so destroyed formed however only a minute fraction of the whole, and, in the main, the change appeared to be a purely local one, as, with the exception of the terminal fan-shaped expansion, there was apparently little or no tendency for the fibrous tissue to spread out into the surrounding renal substance.

Sound union therefore took place at only three points, and one can readily understand how these bars of fibrous tissue would stretch, if any constant strain were thrown upon them.

In the decapsulation series, the greater part of the posterior renal aspect was bared by an "I"-shaped incision through the tunica propria. The two lateral flaps so formed were reflected laterally, and, all intervening fat having been removed, the kidney was fixed to the posterior abdominal wall by eight fine silk sutures (size oo).

These sutures picked up the capsule of the kidney only, and were arranged laterally, four on each side. Both ends of each lateral suture were passed through the cut internal oblique and transversalis muscles of their own side at some distance from the free margins, and the incision itself closed by fine interrupted silk before the kidney sutures were tightened, the two ends of each ligature being tied together. Within a period of three to six weeks, this method resulted in extremely satisfactory macroscopic and microscopic union.

Sections through the kidney and attached layer of muscle showed that a new thick capsule of dense fibrous tissue had been formed. From this newly formed capsule of young fibrous tissue, small round cells could be traced downwards into the renal cortex for a depth of four to eight layers of tubules. In places, where the sutures had included small portions of renal cortex within their grasp, the invasion was considerably deeper, but in no place had the renal destruction been so complete as in the former method. The renal epithelium was extremely vacuolated in places, but there were no actual empty spaces.

Some of these sections showed extremely well the importance of the complete removal of all intervening fatty tissue. In some places where this had not been completely resected, no attempt at union was shown; but, in others, a very weak result was obtained by invasion of the areolar meshwork of the fat with inflammatory small round cells, some giant cells, and young fibrous tissue.

With reference to the operation of capsulotomy for some cases of acute nephritis with threatened suppression of urine, it is interesting to note that an imperfect collateral circulation between the cortical vessels of the kidney and those of the lumbar parietes was actually established in the decapsulation series of experiments. The renal artery of a cat, whose corresponding kidney had been partially decapsulated and fixed two months previously, was injected at low pressure with carmine gelatine. Microscopic sections of the affected region showed a fair number of the capillary vessels in the lumbar tissues filled with the injection.

Comparing the results then of the two operations, we can confidently assert that that of decapsulation secures by far the more efficient fixation, and that, although it causes degenerative changes in a slightly larger amount of renal tissue, these changes do not appear to progress to the extreme degree as seen in the simple method. There is no evidence, clinical or experimental, that the renal changes, produced by decapsulation nephrorrhaphy, pass onwards into a generalised chronic interstitial nephritis.

We describe, in some detail below, the operation which we regard as giving the most satisfactory results, although we do not claim for this, or any other operation, infallibility in the human subject.

In this, as in other surgical procedures on the kidney, much abdominal pain and discomfort often result in the succeeding 48 hours from tympanites, but this can be lessened by careful preparation of the patient's bowels beforehand, as if for abdominal section. Moreover, a distended ascending colon often bulges into the lumbar wound during the course of the operation, and, besides increasing the risk of wounding the peritoneum, also prevents a clear view of the renal pedicle being obtained, and it may be found necessary to pack it out of the way. For this purpose, a small Cripps' abdominal pad will be found most useful, as it takes up so much less room than the ordinary flat sponge, which at the best is a very cumbersome thing.

It is usually sufficient to give Ol. Ricini ʒvi. on the two evenings prior to the day of operation, and one or more enemata on the actual morning. In addition, small doses of strychnia by the mouth, during the preceding few days, may be found useful. Chloroform is the most satisfactory anæsthetic to employ, because, by securing greater relaxation of the abdominal muscles, it enables the assistant to apply more efficient pressure from the front, in the bringing of the kidney into wound.

The patient lies upon the sound side in the semi-prone position, with a sand-bag under the loin so as to open up the interval between the last rib and the crest of the ilium on the affected side. This space in some patients may be extremely limited. The incision, which should be 4 or more inches in length depending on the fatness of the patient, commences above in the posterior renal angle at the outer border of the erector spinæ, and passes downwards and slightly outwards towards the crest of the ilium. The upper angle of the incision should be about $\frac{1}{2}$ inch below the lower margin of the last rib. As the 12th rib is not infrequently rudimentary, and is occasionally absent, it is safer to count the ribs from above downwards, and so to avoid the risk of opening the lower recess of the pleural sac. The incision should be carried downwards through the almost vertically running fibres of the anterior margin of the latissimus dorsi and the posterior free border of the external oblique, until the transverse fibres of the lumbar origin of the internal oblique are exposed. Two lateral flaps are then made of all the tissues so far divided, by a few lateral sweeps of the knife through the loose areolar tissue, separating the muscular layers until the surface of the internal oblique is bared for an extent of about $\frac{3}{4}$ to 1 inch on each side of the incision. The internal oblique and transversalis are then divided in the line of the original incision. It is not advisable to split the muscles in the direction of their fibres, as a satisfactory exposure cannot be obtained by this means, and the risk of a lumbar hernia, occurring in an aseptic case, is so small that, for practical purposes, it can be neglected. All bleeding points are now picked up and ligatured with fine silk, and the deeper part of the wound sponged out, and exposed by the insertion of a pair of large retractors.

In these cases, in which a large amount of circum-renal fat is the exception, the post-nephric fascia can be picked up with dissecting forceps and incised, and then the perinephric fat broken down with the finger until the postero-external surface of the kidney comes into view. Some difficulty may at first occur in localising the kidney, if it is very movable, and firm steady pressure from the front in an upward and backward direction by the assistant's clenched fist will greatly expedite matters. The kidney may have to be sought for quite low down in the iliac fossa.

Having found the kidney, it is wise before proceeding further, to ligature and remove all fat that will be likely to intervene between the posterior aspect of the kidney in its new position and the lumbar parietes, because not only will this prevent proper fixation, but also, having a very poor blood supply, its vitality will be impaired by the tearing process, and in consequence the presence of these tags will favour the occurrence of suppuration. Owing to the lengthened renal pedicle, no difficulty, other than that occasioned by the free mobility of the organ, will be met with in bringing the kidney out on to the loin ; but, before doing this, some estimate of the space in the upper part of the vertebral recess at the disposal of the surgeon should be formed. The object to be attained is to place the kidney at its normal level in the loin, or, failing that, to fix it as high as space will allow.

The kidney must not be subjected to any downward hepatic pressure, nor any tension put upon the renal pedicle. If careful attention is not paid to these points, the operation will fail.

When the kidney has been brought out on to the loin, a careful examination of it should be made, and any aberrant artery, likely to cause ureteric obstruction, divided if thought necessary, or any other abnormal condition present rectified.

If any suspicion as to the presence of stone exists, the renal pelvis and calices must be opened, and explored by the finger, either by an incision into the convex margin of the kidney, or by a direct opening made into the pelvis of the latter, if dilated.

An incision into the pelvis does not cause the loss of blood that a free incision into the renal parenchyma occasions, and allows of a more thorough exploration, whilst, if it is sutured with fine chromicised catgut, it is not more likely to produce a urinary fistula.

The pedicle of a kidney, which has originally occupied a position on the normal level, will be seen to pass inwards and upwards. If it is observed to run directly inwards, this is good evidence that the renal artery arises from the aorta at a lower level than usual, and consequently the kidney must not be fixed so high as it otherwise would be.

The process of partial decapsulation is effected by an "I-"shaped incision through the tunica propria, the perpendicular portion of the "I" being situated well towards the outer part of the posterior surface of the kidney.

A sharp knife and a light touch are necessary for this procedure, otherwise the incision will be carried into the renal cortex, and a certain amount of unnecessary oozing will be the result. The two lateral flaps, so marked out, separate quite readily, and should be turned outwards and laid flat upon the surface of the kidney. The denuded area should have a long diameter equal to two-thirds of the long axis of the kidney, and its breadth should be about 2 inches or slightly less. The sutures of fine silk (size 0 or 1) should now be passed by means of a rounded intestinal needle; eight, as a rule, are sufficient, and should be arranged as shown in the accompanying figure.

The three lateral sutures on each side take up, by means of an in-and-out movement of the needle, two layers of capsule, no portion of the renal cortex being included in their grasp.

The two polar sutures take up only one layer of the capsule, and are situated respectively immediately above and below the decapsulated area.

The kidney is now replaced in the renal recess, and the sutures are passed through the lumbar parietes, taking up the internal oblique and transversalis muscles only.

The polar sutures traverse both edges of the muscular layer, but the lateral sutures are passed $\frac{3}{4}$ to 1 inch away from the edge of the incision of their own side. Each end of a lateral suture is passed separately, so that, when the ends are tied together, the suture may include a sufficient piece of the muscular layer to ensure a firm grip. The object of passing these sutures at some distance from the free incisional margin is that they may exert a straight instead of an oblique pull, and will not tend to diminish the breadth of the decapsulated area. None of these renal sutures are tied until the cut margins of the internal oblique and transversalis have been brought together by inter-

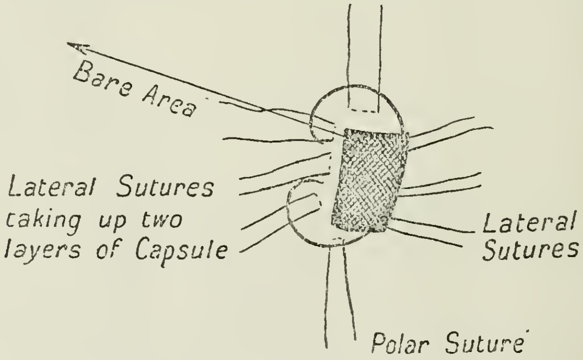

FIG. 11.

rupted sutures of fine silk. When this has been done the kidney is pressed firmly up into the loin by the assistant's hand from in front, and the renal sutures gradually tightened.

It is obvious that the final position of the kidney depends upon the relative level of the decapsulated area with regard to the posterior renal surface, and the levels at which the sutures pass through the edges of the incision.

The normal position of the right kidney requires that the lower two-thirds of the kidney should be decapsulated, and that the upper polar suture be passed through the upper angle of the incision.

The superficial muscular layer is approximated by another row of interrupted sutures of fine silk, and then the skin incision closed by sutures of fishing gut. No drainage is necessary, unless the renal pelvis has been opened, when a rubber tube should be inserted. This can usually be safely removed in a few days, and the sinus allowed to close.

The patient should be kept in bed for at least three weeks after operation, spend the succeeding three weeks on a couch, and be prepared to live a quiet life, avoiding all forms of active exercise, for the next 3 to 6 months. We feel convinced that some cases of nephrorrhaphy fail because the patient is allowed to get up and about before the newly-formed adhesions are sufficiently strong to hold the kidney.

Results of Operation (*Immediate*).—The mortality of nephrorrhaphy is so small as to be almost negligible, and when a fatal case does occur it is due, as a rule, to some accident, such as embolism.

This cannot be regarded as an intrinsic effect of nephrorrhaphy, but rather as a result, which may occur in the course of almost any surgical procedure.

Treves gives the mortality as not exceeding 1 per cent. Schède also places it at 1 per cent.; Keen, 2·9 per cent. In a continuous series of 98 cases of movable kidney, operated on in St. Bartholomew's Hospital during the years 1895–1905, there was no fatal case.

Ultimate Results of Operation.—Keen has recorded a series of 116 cases, at a period of not less than 3 months after nephrorrhaphy, and found that 57·8 per cent. were cured, 12·9 per cent. were improved, and 19·8 per cent. remained *in statu quo*.

P. Fiori, reviewing a series of 30 cases with regard to the relief of symptoms, found that such intrinsic renal conditions as albuminuria, uronephrosis, etc., and vesical or biliary symptoms were cured in 100 per cent. of his patients.

In the relief of pain and vague gastro-intestinal symptoms, he was apparently not nearly so successful.

In forming an opinion as to the result of nephrorrhaphy, two points must be investigated :—

(*a*) The relief of symptoms ;

(*b*) The efficient fixation or otherwise of the kidney.

The following statistics were compiled from a continuous series of 63 cases of nephrorrhaphy operated on in St. Bartholomew's Hospital, from the year 1899 to 1905.

Of these, it was found possible to follow out, and personally examine 41, and the investigation was conducted upon the lines indicated above.

Of the cases not traced, failure was due to the fact that almost all of them had changed their addresses in the interim, and, as is so common in hospital patients, had left no record of their subsequent movements.

One case only, so far as we could ascertain, had died, death being due to an intercurrent pulmonary affection, having no relation to the patient's renal trouble.

These patients were examined at periods varying from 1 to 7 years after operation, and the results placed into one of four groups:—

(i) Cured ;
(ii) Greatly improved ;
(iii) Improved ;
(iv) *In statu quo.*

In no case was the patient worse than before the operation.

The present condition of the patients was most carefully compared with the symptoms complained of by them at the time of their previous admission into hospital, and no elastic interpretation was given to the word "cure." The word is used in its strictest sense, and any patient complaining of slight occasional neuralgic pain in the scar, or an aching pain or feeling of weakness in the loin after a hard day's work, was placed in the "greatly improved" class.

Of the cases operated on, and personally investigated, 41 in all ; 12 were cured, 8 greatly improved, 12 improved, and 9 remained *in statu quo.* So that approximately 30 per cent.

were absolutely cured, and 49 per cent. improved by the operation.

But on dividing these cases up into the two classes of acute and chronic, very striking results were obtained.

Of the "acute cases" (24), no less than 11 were cured, 5 greatly improved, 3 improved, and 5 were *in statu quo*.

This gives a percentage of 45 per cent. cured, and 33 per cent. improved. In all the latter cases, the symptom complained of was occasional dull aching pain in the posterior renal angle, and, in no instance, had there been a recrudescence of the acute symptoms.

Of the 5 cases *in statu quo*, in 3, the kidney was as freely movable as formerly, and in 1, a subsequent diagnosis of chronic grastric ulcer was confirmed at the operation of posterior gastro-jejunostomy.

So that, if this case of mistaken diagnosis is omitted, and an efficient operation performed, we have a right to expect that 55 per cent. of the acute cases will be cured, and an additional 25 per cent. so improved that an occasional dull ache in the loin, occurring after prolonged exertion, will alone remain.

In the chronic cases, however, the results are unfortunately far from satisfactory.

Of a total of 17 cases, 1 only was cured, 3 greatly improved, 9 improved, and 4 remained *in statu quo*.

This gives a percentage of 6 completely cured, and 70 improved.

Of the cases *in statu quo*, in 1, the kidney was not fixed, and, in 2, the pain was certainly pelvic in origin, but the failure in the fourth case remained totally unexplained.

It is a curious fact that, in 5 cases, in which the affected kidney was as freely movable as formerly, the patients were certainly improved.

But in one of these, there had been no pain during the first year after operation, so that it is reasonable to suppose that the kidney had for a time been anchored, but had subsequently broken loose again.

It would seem as if this was but another example of how important a part suggestion, combined perhaps with a skin incision, plays in the practice of medicine and surgery.

The following case is an example of the importance of not attributing failure to an operation, without a careful re-investigation of the patient.

A young woman, æt. 26, was operated on, in 1903, for a freely movable right kidney of the acute variety. For the first 2½ years, after nephrorrhaphy, she remained perfectly free from all symptoms referable to her kidney, then once again she began to have lumbar pain.

When seen, in 1907, she complained of typical post-renal aching on the left side combined with occasional subacute pain in the umbilical region, usually accompanied by a feeling of epigastric distension and vomiting. On examination, the right kidney was found firmly anchored in position, but, immediately above the navel in the middle line, a floating left kidney was found. The latter could be manipulated with ease into the right side of the abdomen. It was lying with its long axis transversely, and its hilum looking directly upwards.

A left nephropexy was performed, and when seen two months later, the patient expressed herself as being quite free from pain, and her former gastric disturbances.

The after complications of nephrorrhaphy are fortunately few, and are not of a serious nature.

Deep quiet suppuration (staphylococcic) occasionally occurs, especially in those cases of simple fixation, in which deep sutures of thick silk have been employed as suturing material. Of the rest, some must be ascribed to faulty technique, and to the tearing and bruising of the capsula adiposa, which should be as extensively removed as possible. Lumbar hernia may occur, but is decidedly uncommon.

We have seen, in one case, jaundice coming on on the third day, but it was only a slight attack, and passed off completely within a week.

Sometimes a patient may complain of occasional shooting neuralgic pain in the lumbar wound; this, however, passes off in a few months. In one case, we have seen considerable œdema of the right leg, for which no cause could be assigned, there being no evidence of thrombosis. This symptom disappeared in about 3 months, but was accompanied by severe pain along the course of the sciatic nerve, which proved intractable to all forms of treatment up to the time the patient was lost sight of 12 months later.

ON THE FORMATION OF A "FUNDAL" OR "SUSPENSORY" LIGAMENT AFTER HYSTEROPEXY, AND ITS DANGERS.

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[With Plate XX.]

HYSTEROPEXY is a safe and easy operation, and may be relied upon to bring about a certain and permanent cure, when performed in suitable cases of retro-displacement of the uterus. In cases of uterine prolapse and procidentia, however, the permanency of the result is not so well assured, and recurrence is not infrequent.

It was the fertile brain of Lawson Tait that first conceived the idea of suturing the uterus to the anterior abdominal wall for the cure of retroversion and retroflexion, and this operation was first performed by him, in February, 1880, in a woman, aged 32. After removal of the ovaries, he attached the uterus to the anterior abdominal wall, by passing a suture through its fundus, and through the tissues of the abdominal incision.

In a work, published in 1885, Koeberlé stated that, in 1867, he performed cœliotomy for intestinal obstruction, and, at the same time, after removing the healthy ovaries, he sutured the pedicle stump to the side of the abdominal incision, in order to cure a retroversion.

These observations passed almost unnoticed at the time, and it was left to Olshausen and Kelly, simultaneously, but independently, in 1886, to attract attention to this subject. Since then, this operation has been extensively performed by many operators, and many methods have been introduced and extensively elaborated, and an enormous literature has sprung up on the subject.

These many methods, according to Russell Andrews, admit of classification into three main groups, which he describes as :—

1. Indirect Fixation, where the pedicle, formed by removal of the appendages, is fixed to the abdominal wall. This was Koeberlé's original method ; it is still sometimes employed after the performance of ovariotomy and oöphorectomy.

2. Lateral Direct Fixation, where two or three sutures are passed through the origin of the round ligament and part of the broad ligament, and fix the uterus to the parietal peritoneum and abdominal aponeurosis at the side of the incision. In this method, no adhesions are formed between the uterus and the scar tissue in the abdominal wall.

3. Median Direct Fixation, in which the methods are numerous and varied. Thus the posterior surface, the fundus, the anterior wall, and the anterior surface of the fundus, the anterior surface, and the lower part of the anterior surface only, are the various parts of the uterus chosen for fixation by different operators. The parts, to which the uterus may be fixed, are :—the peritoneum only, the peritoneum and subperitoneal tissue, or the peritoneum and the posterior fascia of the rectus respectively.

The sutures fixing the uterus may be passed, according to the predilection of the operator, through the whole anterior abdominal wall, through the whole abdominal wall minus the skin and subcutaneous tissue, or through the peritoneum and fascia only. Finally, the fundus or the uterine and parietal peritoneum may be scarified before fixation, in order to produce firmer adhesions.

From a consideration of these various methods, we may conclude that hysteropexy includes two different operations, which may be distinguished as "ventro-fixation" and "ventro-suspension" of the uterus.

Ventro-fixation of the uterus, which permanently fixes the uterus to the abdominal wall, or secures a wide surface of attachment and completely, or almost completely, immobilises the uterus.

Ventro-suspension of the uterus, the procedure devised by Kelly, and named by him "suspensio uteri," consists in passing two fine silk sutures through a small area of uterine parenchyma, and through the peritoneum of the abdominal wall.

By this means, the uterus is suspended to the abdominal wall first, directly, and then through the development of a thin fold of connective tissue, one or two inches in length, which usually assumes the character of a false ligament. It is to this structure that the name "Fundal," or "Suspensory Ligament," is applied.

Holden analysed the results obtained in 900 ventro-suspensions performed in the Johns Hopkins Hospital. In 19 of these, a second laparotomy was performed later in the same hospital. In every one of these a "fundal ligament" was found. It was usually a single band, or one or two cords. The length averaged from 3 to 5 cm. After a year, the length of the ligament did not depend on the time elapsing since the operation, or on the thickness of the ligament.

Beyea introduced a modification of the technique, and has performed the operation upon 465 women. He deliberately attempts to establish a "fundal ligament," for he states his aim to be as follows :—

"The object of the operation of ventro-suspension is to secure the uteri to the anterior abdominal parietes forward in an exaggerated normal position, so that in the succeeding weeks, through the mobility of the organ, its traction on the abdominal walls with, for instance, distension of the bladder and changes in the tension of the abdominal wall, a ligament is formed, or pulled out to maintain the uterus in its normal position. This ligament must be of just sufficient strength to maintain the uterus forward, as it were, as a guy rope, must not be attached or involve a wide surface of the uterine parenchyma, and the tissue forming the ligament must be of such a character as to undergo hypertrophy and hyperplasia, or stretching, during the growth of the uterus during gestation. . . . Of equal importance, the suspension ligament must be of sufficient strength, the primary attachment to the abdominal parietes also of sufficient strength to secure against its rupture and the recurrence of the malposition of the organ from the time of operation."

Three uteri, which show very well this "fundal" or "suspensory" ligament, and which have been removed for pain and hæmorrhage at various periods after the performance of hysteropexy, have recently come into my hands. The particulars of these cases are as follows :—

Case 1.[1]—A single woman, aged 29, was admitted to the Chelsea Hospital for Women, on November 25, 1905, under the care of Dr. W. H. Fenton. She complained of dysmenorrhœa so severe as to cause vomiting, menstruation being irregular, the loss being excessive and accompanied by clots; there was also some vaginal discharge.

Menstruation had commenced at the age of 20, and was always painful, irregular, and variable in amount from the commencement. The patient had had gastric ulcer seven years previously, and pleurisy two years previously respectively.

She was an in-patient in the Women's Hospital, Birmingham, in May, 1905, where an operation, said to be curettage, was performed. No improvement followed, patient being unable to move about during menstruation on account of severe abdominal pain.

A satisfactory pelvic examination was only possible under ether, and this was made by Dr. Berkeley, on December 12, 1905, when the uterus was found to be retroflexed. Dr. Fenton performed hysteropexy on December 8, a satisfactory recovery followed, and the patient was discharged on January 2, 1906.

Again there was no improvement, and, in addition to dysmenorrhœa, the patient was never free from a constant gnawing pain in the left iliac region. She accordingly went into the Radcliffe Infirmary, Oxford, where she remained without any definite benefit for three months. No surgical treatment seems to have been undertaken there.

She returned to the Chelsea Hospital for Women for hysterectomy, in March 1907, and, on March 15, supravaginal hysterectomy was performed by Dr. Fenton. There was a good recovery, and the patient was discharged on April 2, quite relieved of all her symptoms.

On examination of the body of the uterus, which had been removed, it was found to be uniformly slightly enlarged, and springing from its anterior surface near the fundus, was a "fundal ligament" 1 inch broad and 1¼ inches in length.

Case 2.—A married woman, aged 38, was admitted into

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[1] The specimens from Cases 1 and 2 were shown at the meeting of the Obstetrical Society of London.

PLATE XX.

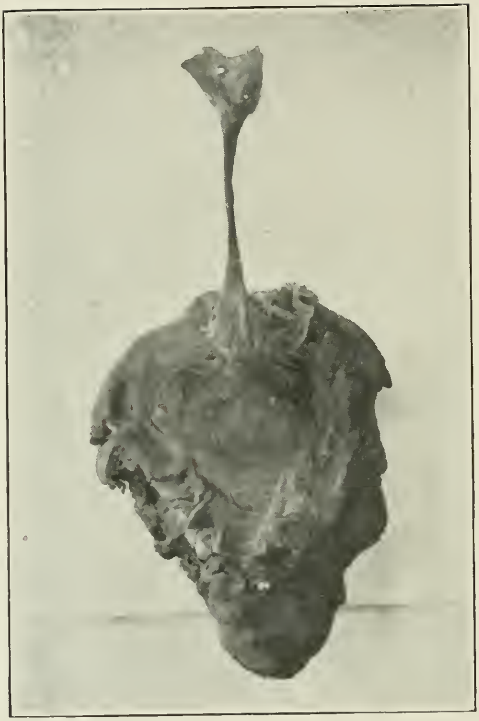

Fig. 1.—*Uterus showing fundal ligament, 2½ inches in length, removed eleven years after hysteropexy.* (*Case* 2.)

the Chelsea Hospital for Women, on June 21, 1907, under Mr. Bland-Sutton's care, complaining of painful and excessive menstruation. She had had two children, 18½ and 17½ years ago respectively, and one miscarriage, 14 years ago.

Left salpingo-oöphorectomy and hysteropexy were performed in the Middlesex Hospital in 1896. Since then the catamenia have been very irregular, and have occurred every fortnight, lasting seven days, the loss being very profuse, and always accompanied by very severe pain.

Abdominal hysterectomy and right salpingo-oöphorectomy were performed on June 24, 1907.

The removed uterus (Fig. 1) was slightly and uniformly enlarged, the tip of the cervix being absent. It measured 3 inches in length, and weighed 3½ ounces. Attached to the anterior wall, just below the fundus, is a "fundal ligament" 2¼ inches in length and a little thicker than a goose-quill.

The removed right appendages showed slight chronic inflammatory changes, the tube and organs being adherent to each other, but the abdominal ostium of the tube was patent, and the ovary contained a recent corpus luteum.

Case 3.—A woman, aged 29, was admitted into the Chelsea Hospital for Women under Mr. Bland-Sutton, on May 2, 1907, complaining of irregular uterine hæmorrhages. She had been married 4 years, and had had one child 2½ years ago, and no miscarriages. Eight years ago, hysteropexy was performed by Dr. Herman. Since then there had been irregular uterine hæmorrhage, the catamenia occurring every 14 to 21 days, lasting 5 to 7 days, with very free loss accompanied with clots.

On examination, the scar of the previous cœliotomy was evident. Bimanually, the uterus showed some irregularity in the left cornu, extending into the broad ligament. The adnexa presented no evident lesion. A tentative diagnosis of uterine fibroid was made.

Cœliotomy was performed on May 6th, and the uterus was found ventro-fixed and in good position, with a loop of sigmoid colon adherent to its anterior surface. The uterus was removed by sub-total hysterectomy, and the left appendages were also removed.

The removed uterus was slightly and uniformly enlarged, and had the left appendages attached to it. A "fundal ligament," 1½ inches in length, sprang from its fundus. The uterus measured 2½ inches (a portion of the cervix being absent), and possessed walls ⅞ of an inch in thickness. There was no fibroid present. The endometrium was normal. The removed appendages showed chronic inflammatory changes, the Fallopian tube being thickened and indurated and the ovary sclerotic, there being many external adhesions.

Microscopically, the endometrium was somewhat thickened, some of the glands being dilated. In places, there were small collections of round cells. The myometrium contained many thick-walled blood-vessels. These findings are typical of the condition known as uterine fibrosis, which is a frequent cause of excessive uterine hæmorrhage.

Although both ventro-fixation and ventro-suspension are both highly satisfactory, as regards the cure of uterine retro-displacements, each method possesses certain grave disadvantages.

In ventro-fixation, where the uterus is rigidly fixed to the abdominal wall and immobilised, its immobility interferes with the physiological expansion of the uterus during pregnancy, and with its proper contraction and refraction during labour. It may thus become the cause of serious dystocia. Overwhelming evidence on this point has been collected in an exhaustive Critical Review by Russell Andrews (*Journ. of Obst. and Gyn. of the Brit. Emp.*, 1905), to which the reader is referred.

With regard to ventro-suspension, there is no interference with pregnancy and labour, because of the free mobility of the uterus, but the subsequent formation of an unsupported ligamentous band, stretching across a portion of the peritoneal, and firmly fixed at both ends, namely, the anterior abdominal wall and the surface of the uterus, introduces a serious risk of intestinal obstruction by strangulation over a band. The dangers of such peritoneal bands are fully set forth in the section on "Strangulation by Bands and Through Apertures" in Treves' classical treatise on Intestinal Obstruction, where he states that, "to be capable of producing a strangulation of the intestine, the band must have at least two fixed points of attachment, and there is scarcely any conceivable combination of connected points which is not illustrated in the history of these adhesions" (p. 34).

Nor is this danger merely a theoretical one, for fatal cases of intestinal obstruction, due to such a band formed after hysteropexy, have been recorded by Olshausen, Jakobs, Kreutzmann, Wallace, and others. It is to avoid this complication that operations have been devised by Doran and by Wallace, the object of which is to obliterate the "dead space" which is left below the place of attachment of the uterus to the abdominal wall, and so prevent the possibility of the subsequent occurrence of intestinal obstruction.

MALIGNANT DISEASE OF THE TESTIS.

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A CLINICAL STUDY OF 57 CASES.

MALIGNANT disease of the testes is not of frequent occurrence, and comparatively few surgeons have an opportunity of examining a large series of cases. The following figures and cases are taken from the records of the London Hospital for the last 20 years, and the writer has had the opportunity of examining all the specimens, and a number of the patients described.

In the 20 years, about 110,000 male patients have been admitted to the hospital, and of these only 65 were suffering from malignant disease of the testes, or about ·06 per cent. of all male patients.

Out of these 65 patients, the writer has been able to verify the diagnosis, by the microscope, in 57 cases, and to obtain a good clinical history.

At the present time, a complete classification of growths of the testis is not possible, but from the clinical point of view, if not from the pathological, all new growths of the testis must be considered to be malignant, in spite of the fact that enlargement of the organ may have been present for years without secondary deposits occurring. Whether a purely innocent new growth of the testis occurs is doubtful,[1] and the growths, described as adenomata, differ very distinctly, both clinically and pathologically, from the simple adenomata seen in other organs, such as the breast. In some cases the tumour is apparently encapsuled, and shut off from the normal testicular substance, but, after complete removal of the organ and the tumour, recurrence has occurred in the lumbar glands, and in distant organs.

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[1] Lecene and Chevason (*Rev. de Chir.*, No. 2, 1907) have described small nodules, never larger than a pea, occurring in ectopic testes, which they think are true adenomata. They have never seen them in the normally placed organ.

The classification of malignant tumours is in an equally unsatisfactory condition, some pathologists terming carcinomata tumours, which other pathologists term sarcomata, whilst others again call them endotheliomata, chorion-epitheliomata, embryomata, or malignant teratomata.

These different opinions are based upon the different and varying appearances seen under the microscope, in different parts of the same tumour, and upon different ways of interpreting the appearances seen. These pathological distinctions can only be made after the tumour has been removed from the body, so that, clinically, all cases should be described as malignant disease of the testis, and no attempt made to define the particular variety. The clinical history and the physical signs give little or no information as to the type of growth present, and, when the pathologists cannot agree, there is little use in the clinician labelling a tumour as a carcinoma, or a sarcoma. In every case, the treatment is removal as soon as the diagnosis is made.

It may be of interest, however, to sometimes differentiate between those tumours, which are found to be chiefly composed of fibrous tissue, cartilage, and cysts, the so-called fibro-cystic tumours, and the solid fleshy tumours, which entirely replace the normal organ.

Of the fibro-cystic variety of tumour, there were 7 examples amongst the 57 cases, all of which showed similar microscopic characters, and these characters were never seen in the remaining 50 solid growths.

Age of the Patient.—In the present series of 57 cases, the oldest patient was 60, and the youngest one year old, the average age being 32. Five cases only occurred in children before the age of 12 years, and, if these cases are omitted and the adult patients alone considered, the average age is just over 34 years, which is rather earlier than the usual age incidence of carcinoma.

All the cases in children were solid tumours without any trace of cystic growth, and the age incidence of the cystic tumours lay entirely between 25 and 35 years.

Cases of malignant growths of the testis have been described in patients over 80, and fibro-cystic disease has been met with in infants.

Side Affected.—The disease occurred 33 times on the right side and 24 on the left, and in no case were both organs affected. Monod and Terrillon have, however, described a special variety of sarcoma, which has a tendency to attack both testicles at the same time. It is considered by them to be a form of lymphadenoma, but, like the other tumours of the testis, its pathology is in dispute. It is possible that the cases are secondary deposits to tumours in some other part of the body.

Relation to Retained Testis.—Whether the imperfectly descended testis is more liable to malignant disease than the normally placed organ has been for years a disputed point. Jonathan Hutchinson, Junr., in the New Sydenham Society's Atlas of Diseases of the Testis, states that imperfectly descended testes appear to be specially liable to the development of new growths, whilst Macadam Eccles, in his work of the *Imperfectly Descended Testis*, says, "from these and other facts it would seem that the generally accepted statement, that malignant disease of the imperfectly descended testis is more common than that of the normally placed gland, cannot be substantiated."

The question is a most important one, in view of the modern treatment of the imperfectly descended testis. The operation of orchidopexy is almost generally admitted to be unsatisfactory, and, if malignant disease is more prone to attack the retained testis, this would be a strong argument in favour of removing the organ rather than leaving it alone, or returning it to the abdomen.

The record of 57 almost consecutive cases, seen over a period of 20 years in a large general hospital, would seem to eliminate most statistical errors, and, if this is agreed to, the figures of the London Hospital show that malignant disease is certainly more common in the retained than in the perfectly descended testis.

Out of the 57 cases, no less than 9 occurred in the retained testis, or 15·7 per cent., which is a far higher proportion than the number of cases of retained testis to normal individuals. In 8 of these 9 cases, the testis was retained in the inguinal canal, and, in the ninth, it lay just below the external ring. Two of the cases gave very clear accounts of recurring attacks of pain and swelling in the retained organ, which were probably due to recurring torsion of the spermatic cord.

Cases of malignant disease of an abdominal testis have been described, and are well known, but no case was met with in this series. There was also no case of malignant disease, occurring in a perineal testis, and this is probably accounted for by the fact that the testis, in this position, is operated upon at an early age, and either removed or placed in the scrotum.

Two other cases are of interest, with regard to the position of the testis. In one, the patient had a retained testis in the left inguinal canal, and the malignant disease developed in the right fully descended testis. In the other, the testis was stated to have been normally descended till the patient was 7 years old, but, at that age, it became displaced into the inguinal canal by an injury, and remained there till the growth developed at the age of 37.

In all of the cases of retained testis, the growth was solid and fleshy, but a few cases of cystic disease have been described in the retained testis.

Cause.—The cause of malignant disease in the testis, like the cause of malignant disease generally, is unknown, but many writers have pointed out the frequency with which malignant disease of the testis has directly followed an injury to the organ. Some writers have put the proportion as high as 50 per cent.

In this series, definite statements, as to whether an injury preceded the disease or not, were made in 37 cases. In 27, there was no history of injury; in 8, a definite recent injury preceded the growth; in 1, the history of injury was definite, but preceded the growth by some years, and, in another, the onset of the disease dated from an "acute inflammation." The patient was laid up in bed for three weeks with pain and swelling of the organ, and, five months later, was seen with a large tumour of the testis. No cause of the acute inflammation was given or discovered, but it may have been a case of torsion of the fully descended testis.

Venereal disease does not seem to play any part in the ætiology. In 32 cases, in which the information was obtainable, 29 denied venereal trouble of any kind, one had had both syphilis and gonorrhœa, one had had gonorrhœa, and the other soft sores. The denial of syphilis is, of course, not conclusive, but none of the patients showed any sign, past or present, of that disease.

Period of the Disease when first seen.—For this, the statements of the patients, as to when the swelling first appeared, have to be relied upon. The longest time that swelling was said to have been noticed, in the 57 cases, was eight years, and this occurred in one of the cases of retained testis. The shortest time was three days, and this case occurred in an infant, the mother's statement being taken. The average time was from 6 to 12 months, but examples of more than one year were not uncommon. Taking the cases of cystic disease alone, the longest period that the disease had been noticed was 18 months, and the average time was about six months.

Clinical Symptoms.—The usual reason given for coming to the hospital was the enlargement of the organ. Some of the patients complained of a dragging pain in the groin, and pain across the loins, but the usual reply as to why advice had not been sought before was that "it did not pain."

One patient, referred to above, dated the disease from an attack of acute pain and swelling five months previously, but, on admission to the hospital, he complained of no pain. It was usually only when the tumour became large and heavy, and dragged on the spermatic cord, that the patient complained of any symptoms beyond inconvenience. Later, with secondary deposits in the lumbar glands, there may be sharp attacks of abdominal pain, and, with deposits occurring in other organs, there are the usual signs and symptoms of malignant cachexia. Frequently there are, in these later stages, well marked ascites and œdema of the lower extremities from pressure on the large abdominal veins. The sexual power was unaffected in all the cases, in which inquiry was made, and this is what would be expected, when it is considered that only one testis is involved.

Physical Signs.—The disease, in all the 57 cases, affected the body of the testis primarily. The body was uniformly enlarged, the growth for a long period being confined by the tunica vaginalis. In several of the cases the growth was the size of a cocoa-nut, and yet the testis retained its usual shape, and was smooth to the touch. In many of the cases, however, before the tumour reached a very large size, there were localised bulgings of the tunica albuginea, giving a nodular feel to the organ, and these spots were softer to the touch than the rest of the tumour. This nodular feeling was most marked in the fibro-cystic testicles.

The feeling of unequal consistency, in the various parts of the tumour, may depend upon the development of cysts, hæmorrhage occurring in the growth, areas in which the cells have undergone necrosis, or to localised thinning of the tunica albuginea. In one case, that was seen at an early stage of the disease, a localised hardness could be felt at one part of the testis, which proved, on removal, to be the seat of the malignant growth. In cases of cystic disease with a large amount of cartilage, the tumour is exceedingly hard, but in the rapidly-growing fleshy growths, with a large amount of degeneration of the tumour tissue, the organ feels soft and semi-fluctuant, and, in two cases, was punctured with a trochar in the belief that fluid was present.

The Epididymis.—Apparently none of the growths started in the epididymis, although sarcoma of this part of the testis has been described. The epididymis becomes greatly stretched, and thinned out over the enlarged body of the testis, and this is so marked that, in the majority of cases, it was not possible clinically to differentiate between the body and the epididymis. After removal of the organ, and bisecting it, the epididymis could be readily seen, but it was often impossible to differentiate it by touch. If the cause is seen early, the component parts of the testicle can be made out, but it is not easy to do so, and chief reliance must be placed on the hard enlarged body. Testicular sensation may be present or absent, depending upon the stage of the disease, and the amount of normal testicular substance remaining. In 13 cases, in which this sign was carefully sought for, sensation was absent in eight, and present in five. When the testicle is supported in the hand it feels heavy, and the patient frequently complains of its weight, but too much stress must not be laid on this sign.

Hydrocele.—It is probable that a slight excess of fluid is present in the cavity of the tunica vaginalis, in the early stages of a majority of the cases, but, clinically, it can rarely be detected, and later, it becomes absorbed, and adhesions form.

Out of 50 cases, translucency was only obtained in five, and of these it was localised to one part of the swelling in three.

A general effusion in the vaginal cavity was found in four cases after removal, but in two of them, although looked for, it was not detected clinically. Three of the 57 patients were quite sure that, after a preliminary enlargement, the testicle became decreased in size, and then steadily enlarged again. This may be accounted for by the absorption of the hydrocele fluid formed in the early stages of the disease. In no case was there a blood-stained hydrocele, as has been recorded by other writers, but, in several, an exploratory puncture was made with a syringe and blood removed. When castration was performed, it was found that the needle had been thrust into the malignant growth, and, in one case, suppuration followed.

The amount of blood, removed in one case by the exploratory syringe, was two drams, and this was thought to have come from the vaginal cavity, but there was no marked diminution in the size of the tumour. After operation, the needle was seen to have been thrust into the tumour, the two layers of the tunica vaginalis being adherent. Examination of the tunica vaginalis, after removal, usually shows it to be thickened, sometimes to a considerable extent, and the parietal and visceral layers are frequently more or less adherent. Sometimes there are small collections of fluid between the adhesions, giving the appearance of cysts, and sometimes there is enough fluid to render part of the tumour translucent (three cases). If the disease is not very advanced, it is usually possible to separate two layers of the tunica vaginalis.

The Cord.—The spermatic cord is usually unaffected, except that it is a little thickened by the increase in the size of the vessels necessary to supply the vascular tumour, and by the hypertrophy of the cremaster muscle that follows the increase in weight. Out of 44 cases, this thickening was marked in three. In six cases, the cord was infiltrated with new growth, and was nodular to the touch. The nodules varied in size from a pea to a growth as large as the normal testicle. The lumbar glands may, however, be affected, and yet no growth be felt in the cord.

The Vas.—The vas remains unaffected, and can be felt running in the slightly thickened cord. If nodules of growth are present in the cord, it may not be possible to feel the vas.

The Scrotum.—The scrotum is at first normal, and the skin is not adherent to the tumour. The first sign of disease, seen in it, is enlargement of the veins on the side of the tumour, due to the increased vascularity, and the difficulty of venous return, owing to the interference with the venous circulation by the mass of new growth. These enlarged veins may be seen to form an anastomosis with the superficial inguinal and femoral veins, so as to relieve the congestion of the part. With advance of the disease and adherence of the two layers of tunica vaginalis to one another, the skin ceases to move freely over the testis, and finally becomes firmly adherent at one part, at which the tumour, if not removed, will fungate.

Glands.—The glands first affected are the lumbar glands, and, out of 53 cases, they were found to be affected in 8, when the patients first came for examination. In two other cases, the enlargement was doubtful, but both patients subsequently died with secondary deposits in the lumbar glands. The lumbar glands are situated on the front of the lumbar vertebræ, and surround the aorta and the vena cava, just below the level of the renal arteries and veins. When the lumbar glands are enlarged in malignant disease of the testis, there is a large deep seated mass to be felt on one side of the spinal column near the umbilicus. This mass is fixed and nodular, and does not move on respiration. It has not the shape or position of a renal or splenic tumour, and the fingers cannot be got under it. There is no expansile pulsation, but the pulsation of the aorta is frequently transmitted through it.

Pressure on the vena cava, causing its partial obliteration, will lead to dilatation of the superficial veins of the abdomen in order to carry on the circulation. Ascites and œdema of the lower extremities will be seen later. The ascites may be due to interference with the circulation through the portal vein, or to secondary deposits of growth on the peritoneum.

The tumour, caused by the infection of the glands, may be so large as to be readily seen on inspection of the abdomen. In one case of the series, the glands chiefly affected were the iliac glands, situated along the external iliac vein, and a large tumour was present in the left iliac region, well below the umbilicus. The inguinal glands were affected in one case without any involvement of the skin of the scrotum. This has been mentioned by other writers, notably by Osler in a recent article, and is explained by Jacobson, "either by a reversal of the ordinary lymph current between superficial and deep glands, or by a direct extension of the disease step by step from the latter to the former." When the growth fungates through the skin of the scrotum, the inguinal glands become enlarged from direct infection.

Cases in Infants.—Five of the patients examined were below the age of 12 years, and this group presents some points of special interest. The oldest was 4 years, and the youngest 1 year, when first seen, and in no case was any reason assigned for the onset of the disease. The periods, during which the enlargement had been noticed, were 3 days, 3 weeks, 6 weeks, 3 months, and 11 months. In the last case, the child was 1 year and 7 months old, so that, if the history is to be believed, the disease started at the age of 8 months.

The enlargement is quite painless, is soft, and gives a feeling of fluctuation. This was so marked in one case that the organ was punctured under the mistaken diagnosis of hydrocele.

Three of the cases had well marked involvement of the lumbar glands on admission to the hospital, and no operation was performed. One died soon after the operation for recurrence in the glands, and the subsequent history of the other could not be traced.

Signs of Growth in the Retained Testis.—There is a large swelling in one of the inguinal regions, with absence of the corresponding testis from the scrotum. In the majority of cases, it is not possible to differentiate the body and the epididymis, but, in some instances, they have been felt distinct. The mass is firmly fixed to the surrounding structures, is hard but often has soft elastic places in it. It steadily increases in size. The veins over the tumour are dilated, and, later, there is œdema of the lower extremity from pressure in the iliac vein. In cases of intra-abdominal tumour, ascites is frequently present, and the tumour can only be felt on careful examination.

Diagnosis.—The diagnosis has to be made from Hæmatocele, Hydrocele, Chronic Orchitis, and Tubercular Disease.

Hæmatocele.—This condition is the one most frequently confused with malignant growth, the usual error being the diagnosis of the more serious condition. If the hæmatocele dates from some recent injury, or if a previous hydrocele was present, the diagnosis is usually not difficult, but, in some cases, the history of injury is completely absent, and again, as has been shown, injury is a frequent antecedent of malignant disease. If the hæmatocele is not recent, and the history of injury is absent, the diagnosis, by means of the physical signs, is not possible. The effused coagulated blood in the vaginal cavity, and, in some cases, the enormous thickening of the tunica albuginea and vaginalis simulate the enlargement of the testis in malignant disease with extraordinary accuracy.

Two cases of hæmatocele recently came under the writer's notice, which had been removed as sarcomata by competent surgeons, and, in neither case, was the diagnosis made until a thorough examination of the tumours was made some months after they had been removed. Another case was shown, before one of the societies, as a case of malignant disease, and no doubt was expressed as to the diagnosis, but, on removal, the case proved to be an old hæmatocele, and the patient could give no account of its origin.

The diagnosis can be settled by waiting and seeing if the tumour increases in size, but, in the case of malignant disease, this delay is dangerous, and the question should be settled by an exploratory incision with permission to remove the organ if necessary.

It must not be forgotten that, occasionally, a blood-stained hydrocele is present with malignant disease, as in a case described by Kocher, in which, after exploring, he removed the tunica vaginalis, and subsequently had to remove the organ for malignant disease of the epididymis.

Hydrocele.—The variety of hydrocele, that can be easily mistaken for a malignant growth, is that with thickened fibro-cartilaginous or calcareous walls. The diagnosis should be cleared up by exploratory incision and not by puncture. If a trochar is thrust into a cystic tumour, serous or mucoid fluid may be drawn off, and give an erroneous idea of the nature of the enlargement, whilst, if blood flows out, a hæmatocele may be diagnosed, when in reality the instrument has been thrust into a vascular new growth. The exploration is followed by removal of the walls of the hæmatocele, or hydrocele, or excision of the testis, if the disease proves to be a malignant growth.

Chronic Orchitis.—Chronic orchitis, usually syphilitic in origin, will simulate a new growth by causing enlargement of the body of the testis. Orchitis is, as a rule, more chronic and indolent than new growth, but the history must not be altogether relied upon, as, in several of the cases of new growth, the patient gave a history of enlargement for years. The epididymis is more readily distinguished in orchitis, and the enlargement of the organ is never so great as in malignant disease. The history and signs of syphilis, and the effect of treatment, are most important in clearing up the diagnosis. Large doses of potassium iodide, combined with mercury, and locally strapping the testis, will usually cause a diminution in the size of the syphilitic testis, but, if this does take place rapidly, an exploratory incision should be undertaken.

Tubercular Disease.—In one case, at least, in this series, the diagnosis of tubercular disease was made instead of malignant disease.

The patient, a man of 53, had had a swelling of the testis for 3 months without pain. The swelling was situated in the lower pole of the testis, and was hard and nodular. It was thought to be in the globus minor of the epididymis, which could not be separately distinguished from it. No changes were found in the cord, the vas, the vesicula seminalis, or in the abdomen ; there was no hydrocele. After removal, the lower pole of the body of the testis was found to be the seat of a very early sarcoma.

In some cases of tubercular disease of the testis, in which the body is affected, and there is much fibrous thickening of the tunica albuginea and vaginalis, it may be extremely difficult to arrive at a diagnosis, but there is usually some soft focus of suppuration in tubercle situated posteriorly. Should the testis be removed under a mistaken diagnosis, it is of no consequence as the same treatment is indicated as for malignant disease.

Result.—Twenty-one of the 57 cases could not be traced after the removal of the testis, and, out of the remaining 36 cases, 8 were alive for some time after the operation, but it will perhaps be best to give their histories separately.

(1) H. D. Orchidectomy, March, 1906. In August, 1907, no sign of recurrence. Gain in weight. Sexual power good.

(2) A. F. Orchidectomy, January, 1903. January, 1905, no sign of recurrence.

(3) H. Orchidectomy, June, 1895. June, 1898, no recurrence.

(4) A. L. Orchidectomy, June, 1906. January, 1907, no sign of recurrence.

(5) H. P. Orchidectomy, August, 1889. Well one year later.

(6) W. P. Orchidectomy, 1903. June, 1907, no sign of recurrence, and patient had married since the operation.

(7) T. S. Orchidectomy, July, 1903. January, 1905, no recurrence.

(8) X. Orchidectomy, April, 1889. March, 1899, no recurrence.

Of the 8 cases, 7 were solid growths, and 1 cystic. It will be seen that, although every effort was made to trace the cases, only 2 patients were definitely known to be alive 3 years after the operation.

Two of the 26 cases died as the result of the operation, one from sepsis, and the other from strangulated hernia. In the latter case, the hernia was the only condition recognised before operation, and the malignant growth was discovered and removed at the same time as the herniotomy was performed.

At the autopsy, it was found that secondary deposits were already present in the lumbar glands.

Twenty-seven of the 36 cases had recurrence of the growth. Of these 18 had definite glandular involvement with a well-marked abdominal tumour, whilst only 2 had local recurrence in the scrotum. Recurrence also occurred in the spleen, kidney, lungs, liver, bones, peritoneum, and inguinal glands.

It is a little difficult to draw a fair prognosis from these figures for several reasons. The patients were all of the lower classes, and the enlargement of the testis was, in many cases, neglected for months through ignorance. The tumour was painless, and the testis kept its normal shape, and so the disease was treated lightly.

The number of patients, who could be traced after some years, was small, in spite of visits to the latest address obtainable, and of enquiry of the neighbours. It may be fairly assumed that, in many cases, the lack of success was due to the death of the patient, but of course many other causes may have operated, and, even if the patient died, it by no means followed that death was due to a recurrence of the neoplasm.

Of the eight cases that were alive for some time after the operation, with regard to four, the time that had elapsed was not sufficient to state that they were cured, for they may succumb to a recurrence.

The general impression left, after considering the above figures, and also figures that have been published by other writers, is that malignant disease of the testis is a very fatal condition, but that early removal of the testis sometimes results in permanent cure.

It is of interest to note that all seven cases of fibro-cystic disease were traced, and that all, except one, died of recurrence.

This solitary exception was alive for one year after the operation, without obvious recurrence, but after that he could not be traced. This result is at variance with the view that some of these cases are of an innocent nature.

Three only of the cases of disease retained testes could be traced. Two of them rapidly died, with recurrence in the lumbar glands, whilst the third was alive and well two years and nine months after the operation. The fatal character of the disease is perhaps due to the large number of lymphatic vessels and veins, which lead from the testis, so that general dissemination occurs early.

Of the 18 cases, who died with definite glandular involvement, all except one had an abdominal tumour within 12 months of the operation, and, in most of the cases, it was evident within six months. Kocher states that glandular enlargement can be detected within 6 to 18 months of the appearance of the scrotal swelling, but this, of course, gives no real help in the prognosis, as glandular involvement must have taken place long before a tumour could be detected. It is probable that most of the 18 cases, mentioned above, had secondary deposits in the glands before the operation.

Treatment.—The treatment of malignant disease of the testis is removal of the organ, as soon as the diagnosis is made.

This should be done, even if there is evidence of secondary enlargement of the lumbar glands, as the patient will certainly be rid of a source of inconvenience, and the danger of the growth fungating will be avoided.

It is true that, in the series o cases quoted, no patient so far as could be ascertained, lived longer than one year after involvement of the lumbar glands, and, in the majority of cases, death took place much sooner, but in only three cases was there local recurrence, and death from internal growth is preferable to a similar death, combined with a fungating mass in the scrotum.

Operation is contra-indicated, however, in cases of advanced disease in which there is a large lumbar swelling, or evidence of secondary infection of other organs, as death will soon close the scene, and it is useless to expose the patient to the danger and trouble of an operation.

Removal, when the cord is infiltrated, will also be useless, as the growth will fungate through the wound, and there may be serious difficulty in stopping the hæmorrhage at the time of the operation.

In the case of malignant disease of the testis of infants, it is useless to operate when there is enlargement of the lumbar glands, as death is so rapid that no benefit can result. If the diagnosis is not absolutely certain, an exploratory incision should first be made, and the diagnosis confirmed before removal.

The modern operation for glandular carcinoma is the removal of the primary growth, the next set of lymphatic glands, and all the fascia containing the intervening lymphatics. As the cases described above show, the spread of the infection, in malignant disease of the testis, is nearly always along the lymph stream, and it would be most desirable, in all cases, to remove the lymphatic glands as well as the primary growth.

The first chain of glands, met with by the stream of lymph coming from the testis, is situated on either side of the aorta from its bifurcation to the level of the renal arteries, whilst the venous return empties into the renal vein on the left side, and the vena cava on the right. To remove the lymphatic glands, therefore, the abdomen must be opened, and careful dissection of the abdominal aorta made, avoiding the vena cava, the sympathetic plexus, the inferior mesenteric artery and vein, and other important structures.

In addition to removing the lymph glands and lymphatics, it would also be desirable to remove a portion of the spermatic vein, in order to prevent spread of the growth by the blood stream. The question to be decided is whether this can be done with safety to the patient, for, at the present time, the chance of recurrence in the lumbar region is very great, and, when recurrence has occurred clinically, it would be practically impossible to dissect off the malignant mass from the important structures in its neighbourhood.

An attempt to answer this question was made by Roberts, who reports a case in the *Annals of Surgery for* 1902. His patient had had the testicle removed for malignant disease, and had had a recurrence in the scar. An attempt was made to remove the local recurrence, and the lumbar lymph glands. The operation was performed, and the glands removed, but the patient developed symptoms of intestinal obstruction, the wound suppurated, and a fæcal fistula formed. An attempt was made to close this, but about two months after the first operation, the patient died of peritonitis. There was already a local recurrence before the patient died, and the operation removed glands, in which were found secondary deposits.

The patient was fat, and the operation presented many difficulties.

Roberts, in his article, recommends the following operation:—As the first step, he would open the abdomen in the median line, remove all the fascial tissue round the aorta from the bifurcation to the renal vessels, and also excise two inches of the spermatic vein on the diseased side. He would then close the abdomen, and, at a subsequent operation, remove the inguinal lymph glands, the spermatic cord, the testicle, and the lateral half of the scrotum.

He admits the difficulty of finding and excising the spermatic vein, and his solitary case of removal of the glands, in 1902, proved fatal..

In view of the modern treatment of cancer, it must be admitted that this operation is desirable, but the writer is not in a position to express views as to its likelihood of success. Desperate diseases, however, require drastic treatment, and that this operation is anatomically possible is certain. If it is rejected, the treatment resolves itself into removal of the affected testis.

The incision should be carried well into the groin, and the cord divided at the internal ring, so that as much as possible of it is removed.

The layers of the abdominal wall should be sutured, as in radical cure for hernia, in order to prevent prolapse of the abdominal contents through the scar.

In the case of malignant growth arising in the retained testis, an attempt should be made to remove it, and in one of the cases quoted above, the patient was well two years and nine months after the operation. While the testis is being removed, care should be taken to ascertain if the cavity of the tunica vaginalis communicates with the general peritoneal cavity. If it does so, the aperture must be closed with a suture, and, after removal of the tumour, the abdominal wall repaired in a manner similar to a radical cure for hernia.

In the case of an abdominal tumour, the operation is similar to that for removal of any intra-abdominal growth, and presents no peculiarity. The cases nearly all die from recurrence.

For permission to publish the account of these cases, I have to thank the Medical Council of the London Hospital.

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SUPPURATION IN THE REGION OF THE PHARYNX.

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Suppuration in the region of the pharynx is a subject of sufficient importance to have attracted the attention of many eminent writers. In nearly every instance, however, the author has confined himself to a consideration of one particular form of suppuration, while he has paid but little attention to the relations which exist between it and the other varieties occurring in the neighbourhood. Many observers have brought forward large numbers of cases, either from their own practice, or which they have culled from the literature; and each has recommended the methods of treatment which, in his experience, he has found most successful. Thus many interesting facts and useful data have been brought from time to time before the medical profession; but facts and data, so collected, are apt to form an ill-assorted and disjointed mass of evidence requiring careful sifting in order to bring into prominence the underlying principles which should be learnt from it. Reviewing the manner in which different authors have dealt with the same subject, it becomes obvious that the nomenclature of the various forms of suppuration in this region has not yet the exactness so necessary for accurate record. Thus the term retropharyngeal abscess is often applied to a collection of pus lying superficial to the pharyngeal aponeurosis under the mucous membrane, to an abscess in the retrophargyngeal space, and even to a cold abscess lying behind the prevertebral fascia. No distinction is drawn between an abscess which starts in the retropharyngeal space, and one which, starting elsewhere, reaches the pharyngeal wall, yet the cause and treatment of the two forms differ greatly. It is no exaggeration to say that an abscess in the retropharyngeal space, and an abscess behind the prevertebral fascia, differ from each other in pathology, bacteriology, and method of treatment, quite as widely as an appendicular abscess differs from one in the psoas muscle. Other forms of suppuration in this region, while not differing from each other to such a degree as the two just mentioned, nevertheless present many points of contrast. The discordant views which we find in the literature may, I think, be traced partly to the want of an exact nomenclature, and partly to the lack of distinction between the different sources of the suppuration.

It is a feeble mind, which divides in order to distinguish, but it is a still feebler one which, refusing to make a distinction of any kind, applies a rigid rule of treatment to a whole group of conditions, without due regard to the exigencies of each case. In this paper I have considered the miscellaneous abscesses, found in the region of the pharynx, and have endeavoured to draw a sharp distinction between each on anatomical, pathological, and clinical grounds, and directed attention to a little recognised form of suppuration between the mucous membrane and the pharyngeal fascia, to which I have applied the term post-adenoid abscess. Throughout, I have used a nomenclature based on the anatomical starting point of the abscesses; and lastly, though little that is new in the method of treatment has been recommended, I have essayed to point out the advantages and disadvantages which attend the methods now usually adopted, and to relegate to each variety the method which, suggested by anatomical consideration, has been found most useful in practice.

I.—ANATOMICAL CONSIDERATIONS.

To understand the position and relations of collections of pus in the neighbourhood of the pharynx, it is necessary first to call to mind the anatomical planes and fascial compartments of the neck. The disposition of the different layers of fascia is best seen in a transverse section of the neck. In such a section, the deep fascia is attached posteriorly to the ligamentum nuchæ, where it is split to enclose the trapezius muscle. At the anterior border of the trapezius, the two layers unite, and pass forward to roof in the posterior triangle of the neck. On reaching the posterior border of the sterno-mastoid muscle, the fascia splits a second time, and encloses that muscle. At the anterior border of the sterno-mastoid muscle, the two layers unite, and pass across the middle line, roofing in the two anterior triangles. From here back to the starting point at the ligamentum nuchæ, the disposition corresponds exactly with that on the opposite side of the neck. The neck is divided into an anterior and a posterior compartment, by a strong prevertebral fascia, which runs transversely across from the deep surface of one sterno-mastoid muscle to the deep surface of the other, passing in front of the bodies of the vertebræ and the muscles, which lie on either side of this part of the spinal column. The prevertebral fascia is attached above to the base of the skull along a line, which runs from one jugular fossa to the other behind the pharyngeal tubercle on the occipital bone. A portion of the anterior compartment is shut off at each side by a special process of fascia on the deep surface of the sterno-mastoid muscle, to form the carotid sheath.

The structure of the pharyngeal wall must now be considered. It is formed by the following four layers :—

(*a*) A thick mucous membrane furnished with numerous glands, and a large amount of lymphoid tissue. This lymphoid tissue is most abundant above, where it is collected into a mass known as the pharyngeal tonsil, and extends forward on to the roof of the naso-pharynx. On tracing the mucous membrane forward to the mouth, the tonsils are found lying between the two pillars of the fauces. It is important to remember that both the adenoids and tonsils lie superficial to the pharyngeal aponeurosis.

(*b*) Outside the mucous membrane is the dense pharyngeal aponeurosis, which is attached to the base of the skull immediately in front of the pharyngeal tubercle, to the Eustachian tubes, and to the internal pterygoid plates.

(*c*) External to the pharyngeal aponeurosis is the muscular coat of the pharynx comprised of the three constrictors, the stylo- and palato-pharyngeal muscles.

(*d*) The outer layer is an ill-defined sheet, termed the bucco-pharyngeal fascia, which is only connected with the prevertebral fascia by loose connective tissue ; this allows free play of the pharyngeal muscles. The interval, between the bucco-pharyngeal fascia and the pretracheal fascia, is known as the retropharyngeal space, and is closed in laterally by the styloid process with the muscles, to which it gives origin, and the upper part of the carotid sheath. Throughout this paper, the term retropharyngeal abscess is applied only to suppuration which starts in this space, and prevertebral abscess is used to designate tuberculous collections of fluid behind the prevertebral fascia. Taking into consideration the anatomical arrangements of the compartments just noted, it becomes obvious that an abscess in the retropharyngeal space will tend to point through the wall of the pharynx; suppuration in connection with the glands about the carotid sheath will reach the surface naturally either in front of, or behind the sterno-mastoid muscle; while a cold abscess, forming behind the prevertebral layer of fascia, would travel outwards behind the sterno-mastoid. These points should be borne in mind when the subject of treatment is under discussion. The neck of a child is relatively longer than that of an adult; but Professor Symington has demonstrated that in children, the larynx is situated fully one vertebra higher than in adults; the space, therefore, with which we are concerned, is relatively shorter in infancy than at a later date.

II.—CLINICAL GROUPS OF CASES.

Abscesses in the region of the pharynx may be divided into the following groups:—

(1) Quinsy or suppuration in or around the tonsil. In the latter situation the abscess lies chiefly in the soft palate, and either palatal or peritonsillar abscess is a better term to apply. The pus is always superficial to the pharyngeal aponeurosis.

(2) Retropharyngeal abscess is the name here given to suppuration which starts in the retropharyngeal space. This variety lies wholly outside the pharyngeal walls between the bucco-pharyngeal aponeurosis and the prevertebral layer of the deep cervical fascia.

(3) Post-adenoid suppuration lies between the lymphoid tissue in the mucous membrane and the pharyngeal aponeurosis.

(4) Suppuration or caseation in the deep cervical glands, lying in relation to the carotid sheath may extend inwards to the lateral pharyngeal wall.

(5) A cold abscess due to spinal caries lies behind the prevertebral layer of the deep cervical fascia.

The relative frequency of these clinical groups, in a series of 75 cases, occurring at the Hospital for Sick Children, Great Ormond Street,* is seen in the following table which, however, does not include cases of suppuration about the tonsils :—

Retropharyngeal abscess - - - -	53
Post-adenoid abscess - - -	3
Suppuration of the cervical glands - -	14
Caries of the cervical spine - - - -	5

The frequency, with which the condition is met during the early years of life contrasted with the comparative immunity of the later years, is well shown in the subjoined analysis :—

Age.	No. of Case.
1 to 3 months - - - -	3
3 ,, 6 ,, - - - - -	7
6 ,, 12 ,, - - - -	18
12 ,, 18 ,, - - - - -	6
18 months to 2 years - - - -	8
2 years - - - - - -	10
3 ,, - - - - - -	11
4 ,, - - - - - -	8
5, 6, and 8 years, 1 each - - - -	3
Total - - - - -	74

In one the age was unstated.

By this table it is made clear that the second half of the first year is the period at which these affections are most common ; in a series of 77 cases published by Koplick,[1] no less than 41 were between the ages of 6 and 12 months. The youngest child in my series was 6 weeks old, its abscess was due to pyæmia ; another was 9 weeks old with a 3 weeks' history ; both were of the retropharyngeal variety.

III.—SYMPTOMATOLOGY AND DIAGNOSIS OF CLINICAL GROUPS.

(1) *Quinsy.*—Suppuration whether in the tonsil itself or between that organ and the pharyngeal aponeurosis, is known under the indefinite term of quinsy ; but tonsillar abscess in the former case, and peritonsillar or palatal abscess in the second are

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* For the kind permission to use these cases, I am indebted to the staff of the Hospital for Sick Children.

better terms to apply to these conditions. Abscess formation at these sites is most frequently met with in the young, and is commonly associated with enlargement of the tonsils. The actual attack is usually the result of an acute tonsillitis, with septic infection of the secretion, which has accumulated behind the plica triangularis, or in the crypts, or may be due to septic absorption from the acutely inflamed tissue on the surface of the tonsil. Patients, who are frequently the subjects of septic sore throats, often give a history of having had one or more quinsies.

The symptoms of the condition, sore throat, pain and stiffness on attempting to swallow, with the local tenderness, are so well known to all that a detailed description is unnecessary. Both the local and general symptoms far exceed the severity of those met with in an ordinary acute tonsillitis. On inspecting the throat, the tonsils are seen enlarged, and may perhaps meet in the middle line, they are dusky red in colour. Over the mouths of the crypts, a yellow exudation is seen, which may even appear membranous in its extent, it can however be usually distinguished from the membrane of diphtheria, by the ease with which it can be removed by a swab. The possibility of scarlet fever accounting for the symptoms must never be overlooked. So far however the appearance does not differ from that of an acute tonsillitis; but, if suppuration is present, one of the tonsils will appear much more prominent than its fellow, and encroach to a greater extent on the faucial space. If pus is situated in the tonsil, a yellow area may be seen denoting the spot where it approaches the surface; in marked contrast to this is the appearance when the pus is peritonsillar. In this case the inflamed tonsil floats on a bed of pus, which not only pushes it downwards and inwards, but carries in with it the tissues of the soft palate. The inflammatory area is spread to a much greater extent over the tissues round about the tonsils, than in the former case, and emphasises the asymmetry of the two sides. On examining the neck, the glands on the affected side are found enlarged and tender, and may even be the seat of secondary suppuration. If left to itself the abscess, as a rule, bursts behind the upper part of the tonsil, and a natural cure ensues.

(2) *Retropharyngeal Abscess.*—As we have seen, retropharyngeal abscesses form the great bulk of those found in this region. This condition is rarely seen, except in quite young children; in 46 cases, in which the exact age of the child was ascertained, the age frequency was as follows:—

Age.	No. of Cases.
1 to 3 months	3
3 " 6 "	5
6 " 12 "	17
12 " 18 "	5
18 months to 2 years	3
2 years	8
3 "	7
4 "	2

The cause, as in other forms of suppuration in the region, is frequently, but not invariably, to be traced to enlargement of the lymphoid tissue of the pharynx and septic infection therefrom. I have however met the affection in two cases, 8 and 10 weeks after the tonsils and adenoids had been removed; Cotter[2] reports a similar case, in a boy of eight months, in whom the abscess formed two months after the removal of adenoids. The children frequently exhibit signs of rickets, to which the lymphatic enlargement is sometimes ascribed. The affection sometimes follows in the wake of infectious diseases, such as scarlet fever or measles, conditions which of themselves are liable to leave some hypertrophy of the pharyngeal lymphatic tissue. Huber[3] reports two cases following diphtheria. I have met with one tuberculous abscess, which was a part of a general tuberculous infection, and unconnected with spinal caries; the origin of another was pyæmic, secondary to abscesses on the thighs and elsewhere. Wounds of the pharynx, and impaction of foreign bodies with injury and subsequent abscess formation, are rare in infants, and no such case was met in this series. In 32 cases, in which the exact position was noted, only four abscesses were situated in middle line. Huber[3] also mentions the paucity in the number of cases, in which the swelling presents in the median line. The reason for the lateral position is obvious, first the lymphatic glands of the space are placed laterally, and secondly, there is little space in which fluid may accumulate in the middle line, while on each side there is ample room. Even if the abscess were to start in the middle line, the strong layers of the pharyngeal wall in front, and the dense prevertebral fascia behind, would guide it outwards to the junction of the posterior and the lateral walls of the pharynx; further out than this it cannot pass, as the space is bounded by the carotid sheath supported by the sterno-mastoid muscle.

Although the term "acute" retropharyngeal abscess is sometimes applied to this condition, the history may be of some considerable duration, for two or even three weeks the symptoms may have been noticed, slight at first, but gradually increasing in severity. In three cases under my own observation, in which the condition was suspected from the general bogginess and infiltration of the whole pharynx, I have examined the children at intervals of two to three days, noted the formation and hardening of a localised swelling with the subsidence of the inflammatory process elsewhere, but failed to obtain the least evidence of fluctuation until the eighth or ninth day, by which time the abscess was only in a very early condition. The shortest time, in which I have seen one appear, is 5 days, while I have discovered a large abscess in a child whose mother could give a definite history of the symptoms lasting 3 weeks, during the last 11 days of which time, dyspnœa had rendered the child incapable of lying on its back. My belief is that the condition is frequently overlooked in its early stages, and then, when found fully developed, the abscess is accredited with a far more rapid formation than is really the case.

The symptoms usually date from a catarrh of the nose and throat, following which the child has begun to snore. The snoring is first noticed during sleep, the sound becoming louder and more persistent. The dyspnœa, at first inspiratory, gradually becomes expiratory as well. With each inspiration there is an in-tugging of the lower ribs, accompanied by a sinking in of the tissues at the root of the neck. A peculiarity sometimes noticed is that the snoring becomes less marked or may cease altogether, if the child is rolled over on to its face. This is accounted for by the fact that, in the prone position, the tongue and soft palate naturally fall away from the bulging pharyngeal wall; the air passage being thus freed, its walls no longer vibrate in the respiratory current. A spasmodic cough is sometimes met with, due to irritation, or obstruction by the swelling, of the laryngeal inlet; for the same reason an alteration of the voice and a peculiar cry, are not infrequent symptoms. Difficulty in swallowing only comes on when the swelling has reached a considerable size; it will appear sooner when the abscess is situated in the middle line and low down than when placed to one or other side or high up. Dysphagia may become so marked that the child can no longer take food, and death may be directly due to inanition. In the breast-fed infant, one of the earliest symptoms met may be that the child has, owing to the nasal obstruction, frequently to let go the nipple in order to breathe through the mouth. Stiffness and rigidity of the head are usually stated to be symptoms of this condition, but my experience would limit this symptom to those cases of suppuration, in which the abscess has started in the glands of the carotid sheath, and thence spread inwards to the lateral wall of the pharynx. These cases are not included here under the group retropharyngeal, but are referred to in Group 4. Stiffness of the head, combined with an indefinite fullness under one sternomastoid, should, I agree, lead one to examine the pharynx, but an abscess which has really formed from the first in the retropharyngeal space seldom produces rigidity. In 15 cases, in which this point was investigated, all were able to move their heads freely. One case in particular illustrated this point. Rigidity appeared with the reaccumulation of the pus two days after evacuation; associated with the reaccumulation, which was very foul, the cervical glands became acutely inflamed.

The diagnosis of the condition, in all but very early cases, is extremely simple. In children who present any of the symptoms described, the throat should be examined. As a rule, the abscess can be seen quite easily as a congested prominence to one side of the back of the pharynx, if the pus is very near the surface a yellowish tinge may be visible on the most prominent portion. Where suspicion as to the nature of the case has been aroused, and inspection alone does not settle the diagnosis, the finger should be inserted first into the upper, and then into the lower part of the pharynx. Great gentleness should be used when introducing the finger for fear of suddenly rupturing the abscess wall. A retropharyngeal abscess may be distinguished from one situated in or around the tonsil, by the fact that it is placed behind the posterior pillar of the fauces, and does not push the tonsil forward. It is differentiated from a post-adenoid collection by its larger size, lower level, lateral position, and also by the fact that it does not pass on to the roof of the naso-pharynx. Sometimes it is difficult to tell whether the abscess has started in the retropharyngeal space, or has extended inwards from suppuration of a gland about the carotid sheath; the greater amount of external swelling, the more common association of rigidity, and the presence of an external source of infection, or many other enlarged glands, all indicate the latter situation as the probable starting place. The absence of rigidity of the neck serves at once, in most cases, to prevent confusion between a retropharyngeal abscess and one due to spinal caries. If however rigidity is present, its duration should be carefully ascertained. In the retropharyngeal variety, the stiffness will have come on suddenly not more than ten days previously, while, in spinal caries, it is a matter of months. The condition must also be diagnosed from laryngeal diphtheria, syphilitic laryngitis, or the presence of a foreign body in the throat. In one case I know of the dyspnœa was thought to be due to the enlarged tonsils and adenoids, and as these were being removed, the respiration stopped, and life was only saved by performing tracheotomy and artificial respiration at once; the presence of the abscess was discovered later.

If left to itself the inflammatory process softens and erodes the overlying tissues, and the abscess bursts into the pharynx. The clinical picture of small infants, drowning in their own pus, from the bursting of a large abscess during sleep, is so often quoted as to lead one to believe that it was of common occurrence. Theoretically, such an accident might happen, but practically it is an event of such rarity that only two cases, so far as I am aware, have ever been recorded. Bokai[4] junior, from his own and his father's[5] experience of 300 cases, reported one death subsequent to the aspiration of pus by a small infant during sleep, no details are however given; Gaupp[6] mentions another case, the reference to which, I have however been unable to consult. The possibilities of pus suddenly flooding the pharynx are as great in a quinsy as in a retropharyngeal abscess, and yet how many accidents are recorded from the many quinsies which have been left to nature? What really happens is that the wall becomes thinner and thinner, until the pus leaks through one or more small openings, and relieves the pressure. An actual gush may take place during a fit of coughing or straining, or while endeavouring to take food, but the pus is at once swallowed, or if the child is old enough may be spat out like any other fluid which suddenly enters the mouth. On one occasion, just as the abscess was about to be opened, I actually saw it burst, but there was no great gush of pus; and after all there is no more reason that an abscess in the throat should, in bursting, suddenly discharge all its contents than there is for a subcutaneous abscess to do the same, and we know that, in the latter case, the process is a gradual one. Though this is the natural course of events, it does not follow that any one would on that account advocate an expectant method of treatment. The practice of early incision, based on the rule that pus should be let out whenever it has formed, is never more urgently called for than in this condition, but the reasons for so doing are of greater weight than those which we have just considered. The danger of leaving the abscess to nature depends on its size and anatomical position, which enable it to interfere to a serious extent with other vital processes. First the dysphagia may advance to such a degree as to prohibit the act of swallowing altogether, and to the ordinary wasting, met with in all septic processes, is added that due to lack of nourishment. Small infants especially are liable to suffer in this way, and may even die of inanition after the obstruction has been relieved. Secondly any impediment to respiration in a child is a matter of gravity; the pliability of the ribs, and the yielding nature of the tissues at the root of the neck, make it very difficult to draw air forcibly past an obstruction. In these circumstances, great muscular effort is needed to obtain sufficient oxygen. The venous state of the blood stimulates the vaso-motor centre, and causes a rise in the blood pressure, thereby adding to the cardiac stress. This strain, if allowed to persist, will completely exhaust the reserve of cardiac energy. In cases of retropharyngeal abscess, where the respiratory obstruction is of some duration, it not infrequently happens that the momentary deprivation of oxygen, which must of necessity occur during the manipulation in the pharynx at the time of operation, causes respiration to cease, and the heart's beat to become imperceptible, if not to stop. In two such cases recently seen, death at this juncture was averted only by the use of artificial respiration and cardiac stimulants. Platot and Variot[7] record a death at this stage; Dabney[8] relates a similar incident: while Mayer[9] gives an account of a child of six months who "gave one gasp and died" when a small tongue depressor was inserted into the mouth. The case already alluded to, in which tracheotomy was performed, is another example of the danger which the patient runs at this juncture. Pressure on the nerves, pressure on the vessels, and pressure from a deap-seated locculus, or even a second abscess farther down, have all been hailed as the cause of the phenomena, but in no case has any satisfactory evidence been brought to support such views. The strongest reason for believing that the explanation which I have given above is the correct one, is that a similar danger is met with in performing tracheotomy in diphtheria, when the operation has been delayed till the respiratory obstruction has worn out the heart; for it must be remembered that the toxic effect of diphtheria has not taken effect at this stage of the disease.

For these reasons, we cannot urge too strongly the importance of early incision. Of the grave complication of ulceration and rupture of the large vessels of the neck, I have had no experience, but Franklin[10] records a recovery, and Bokai a fatality after the accident.

(3) *Post-Adenoid Abscess.*—If suppuration takes place between the mucous membrane and the pharyngeal aponeurosis, it is usually found above the level of the soft palate. Here the mucous membrane, especially in young children, is much thickened by the presence of the lymphoid tissue. A phlegmonous condition may be sometimes seen extending

over all the posterior pharyngeal wall. This however does not, as a rule, progress to the extent of abscess formation. Post-adenoid abscess is a condition which is by no means common, only three being recognised out of this series of 71 cases. It is I believe exactly analogous to suppuration occurring between the lymphoid tissue of the tonsil and the pharyngeal aponeurosis, and is caused by an acute catarrh, which sets up a septic infection of secretion which has accumulated in the deep furrows of the lymphoid tissue, although some observers, among whom may be mentioned Schäffer and Schwaback, suggest that septic infection of the pharyngeal bursa may give rise to the affection.

Post-adenoid abscess is practically confined to children, in whom there are usually found the symptoms associated with adenoids, such as mouth breathing, snoring, restless sleep, and night terrors. To these symptoms are added those of a recent sore throat with a rapid increase in the degree of nasal obstruction, so that air no longer may be inspired, or even expelled through the nose. The glands below the angle of the jaw may be enlarged and tender, but, unless associated with a general infection of the lymphatic tissues of the pharynx, swallowing is not interfered with. As the abscess forms above the level of the soft palate, no swelling can be noticed from the mouth. If the child will allow examination by means of the mirror, a prominent mass of adenoid tissue is seen more or less completely blocking the naso-pharynx, the collection may, as in one case actually seen, push forward the soft palate. The diagnosis usually rests on the digital examination. On passing the finger up behind the soft palate, a characteristic firm cystic swelling is met, covered with adenoid growth, and feeling quite different from the ordinary soft sensation of adenoids. The abscess is rarely of any great size, and, in each of my cases, was situated in the middle line. It may extend forwards on to the roof of the naso-pharynx, a position never assumed by a true retro-pharyngeal abscess. Occasionally a marked forward projection from the anterior arch of the atlas, or the body of the axis, is found in this region, but the absence of an acute onset, and the consistency of the prominence serve to distinguish the two conditions. Nasal diphtheria and congenital syphilis may cause general infiltration but not the local swelling; a bacteriological examination in the former, and the history and associated evidence in the latter, make it easy to avoid confusion.

(4) *Suppuration or Caseation in the deep Cervical Glands.*—Suppuration of the glands lying about the carotid sheath under the sterno-mastoid muscle, is more often traceable to infected sores on the scalp, face, or neck, than to septic absorption from the throat, although that misfortune is by no means uncommon. In rare instances pus from the mastoid antrum, instead of coming to the surface through the outer wall of the mastoid process, may burrow deeply in the tissues of the neck, which abscesses, if left to themselves, generally burst through the external auditory meatus, and pressure on the swelling in the throat causes pus to flow from the ear. In place of an acute infection, the collection may be due to the caseation and liquefaction of tubercular glands in this region; and it must be remembered that an acute infection may always supervene in glands which have been known to be tuberculous. Depending mainly on the position of the glands affected, the abscess will bulge in front of, or behind, or lie directly under cover of the sterno-mastoid muscle. In the last-mentioned situation, the abscess may push in the lateral wall of the pharynx, and simulate a retropharyngeal abscess, but very rarely is the faucial space encroached upon to the same extent as by a retropharyngeal abscess. There is seldom the same amount of dysphagia or dyspnœa, and there is hardly the same anxiety or urgency about the case. There is no need to detail the symptoms of a complaint, so common as acute cervical adenitis, but I would emphasise the fact that rigidity and stiffness of the neck are caused by extension of the inflammatory process to the muscles. The lack of differentiation between suppuration in this situation, and that starting in the retropharyngeal space has caused the rigidity of the former to be also ascribed to the latter affection, in which it is but seldom found.

The diagnosis of such cases presents no difficulty, but the exact time at which suppuration starts is not always easy to determine. If left to themselves, these abscesses nearly always point externally either in front of, or behind, the sterno-mastoid muscle, but may burrow deeply among the tissues of the neck before so doing. Only in rare instances, do they burst through the lateral wall of the pharynx behind the posterior pillar of the fauces.

(5) *Spinal Caries.*—In tuberculous caries of the anterior part of the cervical vertebræ, a cold abscess may form behind the prevertebral fascia, which then bulges forwards and encroaches on the pharyngeal space. From inspection and digital examination of the throat, there is nothing to distinguish this swelling from that due to collection of pus in the retropharyngeal space except that in the latter, the pharynx may show signs of recent inflammation. But careful inquiry into the history and symptons makes the difference between the two affections very obvious. In tubercular caries, pain is a constant and long-standing symptom, and is increased by pressure on the head. Rigidity and stiffness of the neck are invariable, and have probably been noted for weeks or months before the gradually increasing difficulty in swallowing and breathing draw attention to the pharynx. The temperature is not raised, and the signs of an acute process are all lacking. Externally behind the sterno-mastoid muscle, there is usually a fullness on one or other side of the neck. In the majority of cases of this nature, the presence of spinal caries has been known to the parents or to the doctor for a considerable time, and it is only the increasing dyspnœa and dysphagia which reveal the complication. If however the abscess is found without this previous knowledge, a consideration of the preceding points should guide one to a correct diagnosis. Of all the varieties of suppuration at the back of the throat, this is the one which it is most important to recognise.

IV.—TREATMENT.

Burkhardt,[11] in 1888, advocated an external excision for the evacuation of abscesses at the back of the pharynx, in order to be able to treat the cavity in an antiseptic manner, and this teaching, even at the present day, has an influence on the method of treatment. But, at that time, little or no distinction was drawn between the different clinical varieties just enumerated, and, while external incision is undoubtedly the correct procedure to follow in certain cases, there are a large number of others, in which opening from the inside is far more advantageous. The question of an anæsthetic has always to be considered in those cases in which the opening is made from inside the mouth. In infants under one year no anæsthetic is necessary, while in older children a general anaesthetic is a great help, but should not be advanced to such an extent as to abolish the reflex of swallowing; in cases of a very urgent nature, in which dyspnœa is a very marked symptom, a general anæsthetic is better omitted.

(1) *Quinsy.*—For opening any abscess through the mouth the child should be laid on the back with the head dependent over the end of the table, or the shoulders elevated on a sand bag and the head well extended, so that pus may collect in the naso-pharynx rather than run down towards the glottis. The only instruments required for dealing with any of these abscesses through the mouth are, a gag, a sharp pointed knife which has its edge guarded with strapping to within half an inch of the point, sinus forceps, and half a dozen artery forceps in which swabs are ready mounted. If the abscess is in the tonsil, the front of that organ is freely incised. If the collection is peritonsillar, its position in the soft palate should be kept in mind, and the point of the sinus forceps entered about a quarter to a third of an inch outside the anterior pillar of the fauces at the level of the upper border of the tonsil, the blades are separated and the instrument withdrawn, and the escaping pus wiped away, or the child rolled over on to its face, and the pus allowed to run out of the mouth. The cavity is then swabbed out. A method, which I have lately adopted with success, is to remove the tonsil with a large sized guillotine, the pus is rapidly removed with swabs, and any tonsillar tissue that remains, is removed with the finger. By this means, not only is the abscess cavity laid completely open, but the cause of the trouble, the enlarged tonsil, is at the same time eradicated.

(2 and 3) *Retropharyngeal and Post-adenoid Abscesses.*—These two conditions may be conveniently taken together, as the treatment is identically the same. In the case of very young children, it is better to use no knife. The finger is introduced, and with it, as a guide, a pair of sinus forceps is

pushed into the centre of the swelling. The blades are then rapidly separated, and withdrawn while the infant is turned face downwards over a basin. In older children, who are not so easily handled, the forefinger is used to guide the knife to the most prominent part of the swelling, in which a small incision is made. Through the small opening, the pus runs into the naso-pharynx, and is removed with swabs. When most of the pus has escaped, the knife is again inserted, and the incision carried down to the lowest limits of the abscess cavity. Unless this precaution is taken, the opening is very apt to close and allow reaccumulation, and even if the opening remains patent, it fails to drain the lower half of the abscess. There is an almost natural inclination to cut upwards away from the moving tongue, but this procedure does not ensure drainage of the lowest part of the cavity. For want of this precaution in operating, the abscess may require re-opening several times.

Tapping the abscess by means of a trocar and cannula has been proposed and carried out,[12] but frequently the pus is too thick to flow through a cannula of the ordinary size. The following excellent plan, but one requiring special instruments, is recommended by Mr. Kellock. The child is anæsthetised, and laid on its back with the shoulders raised. A needle connected with an aspirator, which has been emptied of air, is plunged into the most prominent part of the abscess, and the pus removed by suction. The needle is then removed, and the opening enlarged in a downward direction with a knife. No special after treatment is needed, beyond the administration of small doses of potassium chlorate, or other oral antiseptic. A gargle is useful for those children who are old enough to make use of one. In the case of small infants, Mel Boracis may be smeared with the finger over the mouth and tongue. During the ensuing week, the finger should, if thought necessary, explore the pharynx to make sure that there is no re-collection of pus. The cavity must heal by granulation from the bottom. Re-accumulation is almost invariably due to an inadequate incision, or to one so badly placed that the lowest recess of the abscess cavity remains undrained. The method of evacuating a retropharyngeal abscess by an external incision has the great disadvantage that instead of opening through the small amount of tissue in the pharynx which quickly heals, a large amount of tissue must be traversed, and a deep external sinus created, which takes weeks to heal, and leaves an ugly scar. There is an additional risk in opening up all the fascial planes of the neck. Moreover the external wound drains badly, and re-collections of pus are by no means uncommon, while with the most skilful operators the thin pharyngeal wall may be ruptured or subsequently give way, and in one case seen, the fistula was open and discharging seven months after the operation. The risk of re-infection from the mouth is far from neutralising the advantages of an internal incision, and in practice can be disregarded.

(4) *Suppuration of the Cervical Glands.*—These abscesses should always be incised from the outside, and not evacuated through the mouth; in addition to the fact that they tend to point externally, there is always the chance that the glandular infection may be tubercular in origin, in which contingency it is necessary to have the wound in a position where it can be treated aseptically. In deeply seated collections under the sterno-mastoid, fluctuation is often masked by that muscle, but if the course and symptoms point to the formation of pus, the absence of obvious fluctuation should not deter one from making an incision. When the abscess lies under cover of the sterno-mastoid, the incision should be placed posterior to the muscle, in the other cases, a transverse incision is made over the most prominent part of the swelling, and the abscess opened by Hilton's method. The cavity is then dried out with swabs. If a sharp spoon is used to remove the broken down glandular tissue, the proximity of the pharynx must be remembered, and care exercised not to use undue force in that direction. The danger of opening into the pharynx is best guarded against by gagging open the mouth, and introducing a finger into the pharynx while the abscess cavity is being scraped. If this is not done, the first intimation of the accident will be the appearance of blood-stained froth in the mouth of the patient. When the cavity is dry, a gauze wick should be used as a drain; if a rubber tube is used, there is always a risk, small though it may be, that the walls of the vessels may be ulcerated under the combined influence of the sepsis

and pressure. The wound must be made to heal from the bottom.

(5) *Spinal Caries.*—It is essential that a tuberculous abscess, in connection with caries of the cervical spine should be opened from the outside and under the strictest aseptic precautions. If the nature of the abscess is not fully recognised, and the incision is made through the mouth, a mixed infection can hardly be avoided, and all the harmful results of a mixed infection of bone will follow. Such a calamity must therefore be looked upon as a serious surgical mistake. The abscess should be treated on the same lines as a psoas abscess. A small transverse skin incision is made at the posterior border of the sterno-mastoid muscle, the fascia is divided vertically. A pair of sinus forceps is then pushed inwards, just in front of the transverse processes of the vertebræ, till the abscess cavity is reached. A sharp spoon or flushing gouge is inserted and the tuberculous lining gently removed. An area of bare bone can usually be found, and, if this is felt to be carious, it should be scraped. Any loose sequestra are removed. While the cavity is being scraped, the finger should be inserted into the pharynx as a safeguard against injuring the anterior wall of the abscess. If a flushing gouge has not been used, the cavity should be flushed out with saline, and then wiped dry. If desired, a small amount of iodoform emulsion may be injected into the cavity. Its benefit, however, is doubtful. Attention is paid to the careful closing of the cavity ; the divided deep fascia is united with catgut sutures, over which the skin is stitched with silkworm gut. The wound is then sealed with collodion, and dressed. The general treatment of spinal caries must be followed, rest being given to the spine, at first by extension and counter-extension while lying in bed ; and at a later date, some supporting apparatus, such as a poroplastic jacket with a head-piece, can be applied, and the child allowed to be taken about in a Phelp's box.

A careful watch has to be maintained for re-accumulation of fluid, for a cold abscess in the neck, as in the dorso-lumbar region, is very likely to recur. In the event of recurrence taking place to any serious extent, exactly the same procedure may be repeated, the cavity each time being carefully closed. This is a method far superior to the old-fashioned one of opening and draining. In the latter case, septic infection, in spite of precautions, is merely a matter of time, and should sepsis occur, the length of time, for which the resulting sinus will discharge, can never be foretold. The patient is often condemned to months, perhaps years, of continual annoyance from the constant discharge, and the necessity of wearing and changing the dressings.

Though this is the usual result of sepsis, in the cases with an open sinus, some may escape, and the sinus close in a comparatively short space of time. I can call to mind a child, in whom an abscess formed as the result of spinal caries in the neck, the abscess bursting into the pharynx. In the pus, which was brought up through the mouth, was an articular process of one of the vertebræ; yet this abscess cavity healed without any further untoward complication.

V.—MORTALITY.

The mortality, in my series of 74 cases, was only 3 deaths, or 4 per cent. This corresponds very closely to that of other writers, for the mortality, in 317 cases of the Bokais, was under 5 per cent. The deaths in my cases were as follows:—

1. A girl, aged 6 weeks, whose abscess was the result of pyæmia, died of that disease.

2. A girl, 9 weeks old, very nearly dead at the time she was admitted, was operated upon and then intubated, but died two days later.

3. A girl, aged 6 months, was admitted in an extremely marasmic state, as the result of inability to swallow; the abscess was opened, but the pus re-collected twice, at intervals of two days. She died of inanition three weeks later.

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SOME REMARKS ON ASCITES, ASSOCIATED WITH HEPATIC CIRRHOSIS, WITH NOTES OF A CASE SUCCESSFULLY TREATED BY THE OPERATION OF OMENTOPEXY.

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In recent years, the treatment of ascites, due to hepatic cirrhosis, by surgical operations, has become recognised as a procedure, which is usually followed by more beneficial results than the older method of oft repeated tappings. It is well, however, that this surgical treatment should not be employed indiscriminately, and that, in order that it may not come into disrepute, only those cases of ascites, which are suitable, should be so treated. It may not be out of place, therefore, to first inquire into the pathological causes of such ascites, with a view to determining in what cases this surgical procedure is indicated. Ascites has been defined as "an accumulation of fluid within the cavity of the peritoneum." It is, of course, only a symptom, and occurs in many different diseases.

Clinically, two well-defined classes of cases may be recognised, in which ascites is associated with cirrhosis of the liver.

In the first class, the presence of free fluid in the abdominal cavity is an early sign, showing itself at a stage when there are not many symptoms of a general systemic poisoning. These cases, being tapped, stand well, and show improvement after such treatment.

In the second class of case, the ascites is present at the late stages, when the general systemic disturbance is well marked. If these cases are tapped and the fluid withdrawn, death frequently occurs, as Hale White has shown, before a second tapping becomes necessary. There are many cases intermediate between these two classes. In these two clinical types of cases, the cause of the ascites was, for many years, attributed solely to the obstruction of the portal circulation, consequent on the narrowing of the portal vein by the contraction of the new formed connective tissue in the liver, and the ensuing rise in blood pressure in the tributaries of this vein resulted, it was supposed, in a transudation of lymph through the capillaries into the peritoneal cavity. Of late years, many facts have been brought to light, which mitigate against the view that this is the sole cause of the accumulation of fluid in the peritoneal cavity. The facts are:—(1) that, in animals, the portal vein has been ligatured by Starling and others, without causing ascites, and (2) that, in thrombosis of that vessel, immediate effusion into the peritoneal cavity does not take place. (3) Further, in atrophic cirrhosis, considerable pressure on the portal vein exists before ascites supervenes, this symptom, as has just been mentioned, being sometimes a late one in the course of the disease. We are forced, therefore, to look for some other main contributing cause, and most authorities consider that this is an inflammatory condition of the peritoneum itself, for, if the transudation from the blood vessels, following on increased blood pressure and consequent injury to the vessel wall, was the principal factor, the natural course of such effusion would, as Allchin has pointed out, be into the lumen of the stomach and bowels, and not into the peritoneal cavity, because "it is on the mucous rather than on the peritoneal surface that the chief engorgement of the capillaries takes place, as is evident by the anatomical distribution of the vessels, and as is shown by the hæmorrhages which take place from the mucous membrane in such conditions."

Having come to the conclusion that the exuded fluid, in both clinical types, is due to peritonitis, the next point of interest is the possible explanation of the clinical varieties. That which seems to account, in the most satisfactory way, for the clinical phenomena, is that, in the first class, the peritonitis is an entirely local condition, running coincidently with the changes in the liver, but not dependent on them, the same poison, which produces the slow inflammatory process in the liver, acting also locally on the peritoneum. The liver, in these cases, is therefore still, as regards its functions, active, the morbid changes in the organ not having proceeded far enough to seriously impair its functional rôle in the metabolism of the body. Drainage of the peritoneum, in these cases, relieves a local condition, the inflamed peritoneal surfaces come together, and the peritoneal cavity becomes more or less obliterated by adhesions. If the poison, which the patient has taken, and which is the exciting cause of all the morbid processes, is withdrawn, the disease may remain stationary, and the patient lead a healthy life for years.

In the second class of case, there is also peritonitis, but this is toxæmic in origin, the destructive changes in the liver cells having proceeded to such a degree that they are no longer able to exercise their normal functions, and, as a result, poisons, which are usually eliminated, find their way into the general system, causing inflammatory changes in many organs ; the peritoneum, kidneys, liver, heart, all showing marked evidence of functional and organic changes.

In these latter cases, removal of the ascitic fluid is in no way beneficial, and would not delay the fatal termination of the disease, the ascites, being a symptom of a general poisoning, not a local one, is more analogous to the effusion into the pleural, or pericardial, cavities, which occurs in the last stages of uræmic poisoning.

In the intermediate cases, both causes of peritonitis may be present, first the local and then the toxæmic.

It will be clear from the above that operative procedure may produce great amelioration of the symptoms in the first class of case whilst being useless in the second, and of problematical value in some of the intermediate cases.

The next point for consideration is what clinical symptoms are present, from which the underlying pathological condition may be induced, and so give the necessary indications for operation or otherwise. One of the first and most important is the result of tapping. If the patient is tapped several times successfully, his general condition remaining good, it is very likely that an omentopexy will be beneficial. If, in addition, there are no evidences of kidney changes, if there is no general swelling, and the enlargement of the abdomen preceded any swelling of the legs, the outlook is also favourable. On the other hand, the presence of marked mitral disease, albumen in the urine, which is constant and not intermittent, and does not disappear on the temporary relief of pressure following paracentesis, changes in the lungs (often tuberculous), the swelling of the legs, preceding swelling of the abdomen, and a progressive deterioration of the general condition, notwithstanding the paracentesis, all these contra-indicate operation as likely to afford much relief. The way in which the operation gives relief is difficult of explanation. It is well known that laparotomy and drainage give good results in such chronic peritoneal conditions as tuberculosis. It has been suggested that the relief takes place by more or less obliteration of the peritoneal cavity, more than by the establishment of fresh channels of collateral circulation, and, in the case noted below, the number of adhesions between the liver and abdominal wall, which already contained large veins, was very noticeable, and yet, notwithstanding this, the quantity of ascitic fluid was large. Further, if the disappearance of the ascitic fluid is mainly caused by the establishment of fresh channels between the portal veins and the systemic veins, this could hardly be looked upon as a very desirable condition, because, as is well known, the portal vein contains many poisons derived from the absorption by its radicals of substances in the alimentary canal, and these poisons would then be circulated directly throughout the system, without being first eliminated from the blood by that most important toxin filter, the liver. Experiment has shown that, in animals, if a direct anastomosis is made between the portal vein and vena cava, the animal rapidly dies on account of the circulation of such poisons. There can be little doubt, however, that this operation is also very beneficial through the increased supply of *arterial* blood, which the surface of the liver receives by the formation of these vascular adhesions between its peritoneal surface and the abdominal wall, such arterial supply tending to nourish and maintain the utility of many of the liver cells near the surface, the blood supply of which, from the hepatic artery, would be greatly diminished by the contracting new connective tissue.

The following are the notes of the case :—John Cararies, a Greek, occupation, shoeblack. At 45, was admitted to St. Leger ward, New Somerset Hospital, Cape Town, on June 20, 1906. Previous history gave no account of any illnesses. There was, however, a history of alcoholism, gin being the drink by preference. History of present illness was that, 14 days ago, patient noticed some swelling of the abdomen, this was accompanied by epigastric pain and diarrhœa, but there was no vomiting or hæmatemesis.

Condition on Admission.—Breathing somewhat hurried, but there was no acute distress, patient being fairly comfortable.

Abdomen was fairly distended, and contained free fluid, the liver and spleen were considerably enlarged.

The heart sounds somewhat feeble but quite clear at apex. A soft systolic murmur was audible over the aortic cartilage. Apex beat in the nipple line. No mitral or other murmurs present. The aortic systolic murmur was attributed to atheroma of aortic origin, there being no evidences of aortic stenosis.

Examination of the lungs showed a diminished respiratory murmur at both bases with a few moist sounds. Prolonged expiration was present at both apices, in front and behind, but no adventitious sounds present. Albumen was present in the urine, but there was no sugar, specific gravity 1020, reaction acid. The quantity passed in the 24 hours varied from 20 to 40 ounces.

There was no swelling of the feet or generalised œdema.

The patient remained in hospital for three weeks, during which time he was tapped once. He left the hospital, July 10, at his own request, his general condition being good, but was re-admitted September 14, 1906, having been tapped twice in the meantime when outside. His condition on re-admission was much the same as when he first entered the hospital, only now, in addition to the ascites, he had swelling of his feet and legs, and physical signs of œdema at the bases of both lungs.

From September 14, 1906, to January 30, 1907, he was tapped 23 times, 294 pints of fluid being removed altogether. After some of the tappings, the albumen would disappear from the urine for a short time, and the swelling of the legs and feet temporarily diminish, only to increase again, as the fluid once more collected in the abdomen.

The fluid drawn off nearly always presented the same characters, the specific gravity being about 1007. The reaction was alkaline, and, on boiling it, it was found to contain a large quantity of albumen.

The patient's general condition continued good, and, as after every tapping fresh fluid quickly accumulated, it was decided to try what amelioration of his symptoms would follow the operation of omentopexy. The intermittent character of the albuminuria, suggested as a cause possible pressure on the venous renal circulation, rather than advanced organic kidney changes ; the freedom from mitral disease, the absence of jaundice, and, further, the swelling of the legs being subsequent to the swelling of the abdomen, all these were indications that the case promised a hopeful result from operation.

The operation was performed on January 30, 1907, by Dr. Thomson, and was as follows :—

The abdomen being opened a little to the left of the middle line as far as the umbilicus, the omentum was found to have acquired firm cohesions, with much enlarged veins, to the anterior abdominal wall below the umbilicus, due no doubt to previous tappings.

The large accumulation ot fluid having been withdrawn, the peritoneum, covering the superior surface of the liver and adjacent inferior surface of the diaphragm, was freshened by friction with gauge, and approximated by a few interrupted gut sutures along the anterior border of the liver. The parietal peritoneum, extending from the liver above to the omental adhesions below the umbilicus, was reflected in either side from the anterior abdominal wall about four inches outwards, and sutured in position, and, to the denuded surface, the omentum was attached by numerous catgut sutures, and the abdomen closed. An opening was made above the pubes sufficient to admit a large drainage tube deep into the pelvis. Considering his condition, the patient stood the operation well.

"The abdomen drained freely for a few days, after which, fluid having ceased to drain, the tube was removed. There was, however, a slight reaccumulation of fluid in the abdomen, and, on February 14, two weeks after operation, 2½ pints were drawn off by tapping, and, again on February 20, 9½ ounces Since then the patient has not been tapped."

A week after the operation, a hard swelling was felt in the left iliac fossa, which gradually extended until it reached nearly to the costal margin and forward towards the middle line. This slowly disappeared, and was probably inflammatory in nature. For a short time, there was also some constipation which was readily overcome by the use of purgatives.

The patient was dismissed on the 2nd of May 1907, his condition in every way being very satisfactory. The urine occasionally showed a slight trace of albumen. He had, however, gained in weight. The superficial abdominal veins were in no way more evident than prior to the operation. The aortic systolic murmur had disappeared.

AN ANALYSIS OF 832 CASES OF SCARLET FEVER, WITH OBSERVATIONS ON THE DIAGNOSIS AND TREATMENT OF THE DISEASE.

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After having, during the last 18 months, passed through an epidemic of scarlet fever of a peculiarly severe type, it has occurred to me that an analysis of the cases with their complications would be interesting, and perhaps not without some value, not only to medical practitioners, but also to those engaged in preventive work.

Inquiries were made into the origin of every case under review, and, at the outset, let me say that it was possible to trace the source of infection in very few of them. In some, indeed, one was almost compelled to admit that the disease arose *de novo*. When making inquiries into the case, I have often been given such a history as the following:—Patient, a child under one year of age, has never been out of doors for two weeks, has not played with other children; parents have not been in contact with any known case from which they might have carried the disease to their child. I say "might have carried," but most improbably so, for, in my opinion, the infection of scarlet fever is not carried, however otherwise communicated, in the clothes of mere contacts; if it were, considering the opportunities of conveying infection, one ought to have direct proof of it every day.

Of the 832 cases under review, 403 did not suffer from any complications whatever, but, after the initial fever, passed through the convalescent stage without mishap. 429 suffered from one or more complications, as set out in the table below, but it will be observed that, in 132 instances, the only complication noted was the enlargement of the glands at the angle of the jaw, which enlargement, in the large majority of cases, was very slight, as shown by the fact that in only 5 instances did the glands break down and need an incision.

I do not think that enlargements of the neck glands alone should be included among the complications, since their presence may be said to depend upon the severity of one of the three characteristic features of the disease, viz., sore throat, and may be looked upon as a constant accompaniment of that condition. Excluding, therefore, these cases from the table, we find that 295, or 35 per cent. of the cases, suffered from complications.

Of the 832 cases, 44, including 2 from pneumonia, 1 from measles, and 1 from pyæmia, died, giving a percentage of deaths to cases of 5·2, a mortality somewhat above the ordinary, but, in addition to the deaths from the intercurrent diseases (which are registered as primarily due to scarlet fever), it will be observed in the table that there were 38 cases of mixed infection of scarlet fever and diphtheria, of which 18 died. Excluding these deaths, the percentage case mortality is a little over 3. All the cases of mixed infection were verified by bacteriological examination.

In this paper I do not propose to discuss the complications of scarlet fever, beyond offering a few general remarks from observations made not only upon these cases in particular, but during an experience of many thousands of similar ones.

In the first place, the presence or absence of complications does not by any means entirely depend upon the severity of the attack of scarlet fever, but, in almost equal degree, upon the condition of the patient when attacked, and, in a less degree, upon the age of the patient. Broadly speaking, the older the patient is, there is less likelihood of complications arising, while a delicate "marasmic" child is liable to complications even with a very mild attack. In the second place, let me draw attention, as bearing on the question of diagnosis and treatment in hospital, to the fact that, in eight instances, patients developed a second attack of scarlet fever in hospital, after exhibiting on admission only very mild manifestations of the disease. In six additional instances, patients developed scarlet fever in hospital, when no manifestations of the disease were observable on admission, and, in seven instances, there was reacerbation of throat symptoms in cases which were exceedingly mild on admission. From these, and other similar experiences, I have come to the conclusion that a fever hospital is not a suitable place for the treatment of *very mild* cases of scarlet fever, *if there is the slightest chance of isolating the patients at home for a few days,* and, in my opinion, these very mild cases are infectious only for a few days. It is not without risk to the patients to send them into hospital, while, on the other hand, the risk of infection *from* them is not great, and lasts only a short time. From very mild cases to cases in which the diagnosis is doubtful is but a step, and I would impress upon the practitioner the fact that it is also dangerous to send the last-mentioned class of cases to an infectious hospital, although they are frequently so sent.

The diagnosis of scarlet fever is not always the simple affair which many appear to think it is, and, in my experience, the mistake in diagnosis most often made is that too much attention is paid to the presence of a rash, and the character of such rash. Scarlet fever is a disease with *three* main characteristics—a definite rash, a definite sore throat, and a definite condition of the tongue ; but it must be remembered that every sore throat is not scarlet fever, every strawberry tongue is not scarlet fever, and, above all, every erythematous rash is not scarlet fever, nor indeed is every scarlet fever rash erythematous. These three signs must be considered in relation to, and in conjunction with, one another. Very often the rash of scarlet fever simulates that of measles, but the distribution and accompanying symptoms are different. Again, the condition of the tongue and the rash bear a definite relationship to one another ; the tongue is furred when the rash is out, the tongue is strawberry when the rash has faded. One does not expect to find a brilliant rash with a strawberry tongue ; indeed, in the vast majority of cases one can tell, from the state of the tongue, the day of onset of the disease. Some doctors, if they do not see the rash, will not diagnose scarlet fever, although the throat and tongue are typical of the disease. The rash may last only a few hours in some cases ; on the other hand, scarlet fever is often erroneously diagnosed when an erythematous rash alone is present, and there is no sore throat or tongue.

A few words as to treatment. Mild cases require no treatment beyond an abundance of fresh air, and a mild disinfecting throat spray. I have been in the habit of spraying the throat with a very weak solution of formalin, and I can highly recommend for these mild cases, as being both agreeable and efficacious, a lozenge lately introduced under the name of formamint, in which pure formic-aldehyde is said to be retained by lactose. I regard these lozenges or tablets as a good prophylactic also against sore throat. I have never had a sore throat myself since I began to use them, although I periodically suffered before, and I always recommend their use to the nurses in the scarlet fever wards.

Fresh air is the most important factor in the treatment of all fevers, and, so far as circumstances will permit, I always insist on the windows of the wards being kept wide open.

For otorrhœa, with profuse discharge, I have found the best results follow the irrigation of the ear with boracic solution, and the subsequent filling up of the ear with boracic powder. When the discharge is slight, the treatment usually adopted is to irrigate the ear with a solution of peroxide of hydrogen, and then drop in three drops of absolute alcohol, which is left in the ear for about a minute. For nephritis with blood, and scanty urine, I put the patient on milk diet, prescribe diuretics and diaphoretics, with loin poultices and free purgation, the patient being placed between blankets.

When the flow of urine is well established, I prescribe iron. Occasionally the albumen in the urine is very persistent, and, after a thorough trial of the usual methods of treatment and severe dieting, I often allow the patients up, and put them on full diet, with the result that then the albuminuria often entirely ceases. And here, much as I deprecate the use of proprietary articles, I must say that I have found sanatogen useful in keeping up the body weight, and the general nutrition of the patient, in the early stage of the treatment of nephritis, when only milk diet is usually allowed.

This food is not only useful in nephritis, but also in the case of those ill-nourished, weakly, rickety children one has to so often treat in hospital, and whose condition is made worse by the preceding fever. Its use was recommended to me by a colleague, and I decided to give it an extended trial. For this purpose, I weighed weekly eleven children convalescent from scarlet fever to whom sanatogen was given, and fourteen other convalescent children of about the same ages, in as nearly as possible the same condition, living in hospital at the same time, and getting the same food. I found that the average gain in weight of the children getting sanatogen was, in five weeks, 4 lbs. 2 ozs., and of those *not* getting sanatogen was just under 3 lbs.

I have also weighed the same child at one time, when not taking sanatogen, and at another when taking sanatogen, and I invariably found that the child improved considerably, and gained more weight when sanatogen was given in addition to its ordinary diet. The following is a note on one case typical of many. H.A., æt. 6. A poorly nourished delicate child. Admitted to hospital in the convalescent stage of scarlet fever. Did not show much improvement in condition until tried with sanatogen, after which he gained in the first week 1 lb. 5 ozs., second week 12 ozs., third week 1 lb. 9 ozs., when he was discharged looking fat and well. It is a most important matter that the physical condition of scarlet fever patients should be improved as much as possible, because, by so doing, the liability to the complications, which so often accompany the convalescent stage of the disease, is thereby minimised.

Another important point, from the practitioner's point of view, to be determined in those cases of scarlet fever treated at home, is the length of the infective period.

It is astonishing how old superstitions linger; even to-day a very large number of practitioners will arbitrarily fix six weeks as the infective period, and some will go further, and aver negligence on the part of the hospital authorities if a case is discharged earlier.

My own opinion is that, in some instances, infection only lasts a very few days. I would not hesitate a moment in discharging some cases in ten days or a fortnight, were it not that, if anything untoward happened, the blame for it would be laid, however unreasonably, upon my shoulders in the present state of medical, and, of course, of public opinion. On the other hand, some cases remain infective for months, and my opinion is (and in the present state of knowledge nothing more than an opinion can be given) that the nose and naso-pharynx are the sites where infection lingers. Children with adenoids and big tonsils, are apt to remain infectious for a long time, and I have repeatedly observed that children, discharged with adenoids and enlarged tonsils, have, even after having been kept in hospital for 12 or 14 weeks, been the source of return cases, and, in some instances, when discharging such cases, I have prophesied what would happen.

TABLE SHOWING COMPLICATIONS IN 832 CONSECUTIVE CASES OF SCARLET FEVER.

Neck Glands alone enlarged.	Enlarged Neck Glands, with other Complications.	Rhinorrhœa alone.	Rhinorrhœa and Otorrhœa.	Otorrhœa alone.		Rheumatic Pains Joints.	Heart Lesions.
				Single.	Double.		
132 5 incised.	81	40 1 case was Hæmorrhagic.	83	79	56	15	12

(*Continued.*)

Nephritis.	Antitoxin administered because of mixed infection Scarlet and Diphtheria.	Attacked with Scarlet Fever while in Hospital.		Post-Scarlatinal Diphtheria.	Superficial Abscesses over Mastoid.	Skin Eruptions.	Exacerbation of Sore Throat.
		After mild signs of the Disease had been observed on admission to Hospital.	When no signs of the Disease were seen on admission to Hospital.				
36 3 of these died, 2 of which were admitted to Hospital with severe dropsy.	38 Of which number 18 died.	8	6	4 Including 2 Tracheotomies, both of which recovered.	12	11	7

Skin eruptions included the following :—eczema, seborrhœa, capitis, herpes, boils, purpura.

The other complications or concurrent diseases met with in these cases during their stay in hospital were :—

Pneumonia, including broncho-pneumonia	11	cases.
Blepharitis marginalis	7	,,
Paronychia ungualis	5	,,
Jaundice	2	,,
Abscesses in axilla	2	,,
Measles	2	,,
Stomatitis	2	,,
Erythema nodosum	2	,,
Perforation of soft palate	2	,,
Pleurisy	1	case.
Mumps	1	,,
Chorea	1	,,
Swellings over tibia	1	,,

Of the 832 cases, 44 died. The remaining 788 left hospital quite well, and free from complications, with the exception of the following :—

15 cases discharged with otorrhœa (4 of these had chronic otorrhœa on admission).
4 ,, ,, ,, albuminuria.
1 case ,, ,, rhinorrhœa.

ON THE NECESSITY OF CAUTION IN DIAGNOSING HYSTERIA.

By BERNARD MYERS, M.D., C.M., M.R.C.S.

It is a matter of comparatively frequent occurrence in the experience of every medical man, for apparently obscure cases, which ultimately turn out to be hysteria, pure and simple, to demand attention, but it is also a matter of occasional experience for him to come across cases which, though looking definitely like hysteria, are found to be a masked disease obscured by hysterical symptoms. These latter cases need infinite care in diagnosis, as otherwise they tend to bring discredit upon our profession and ourselves. The following case will, I believe, prove of great interest, as, although seen by nine medical men, the correct diagnosis was not arrived at by anyone, although several opinions were not very wide of the mark.

The patient, a single lady, aged 31 years, was suddenly taken ill during the present summer, suffering from a rigor and a temperature of 105·2, and some obscure pains in the abdomen. She had not, we were told, been feeling particularly well for several weeks, but there was no ascertainable cause for the sudden rigor. The patient had never been considered "strong," and had had her left hip in instruments for several years when a child; she had also suffered much from rheumatism and anæmia. After the rigor the patient was ill for five weeks altogether, and during the whole of that period had suffered from constipation, the bowels never acting without an aperient or enema. The constipation became more obstinate in the fourth and fifth weeks of her illness, and, for the last eleven days, it was practically absolute, although flatus continued to be passed, especially after an enema. Very slight discomfort was ever caused to the patient by the enema, and she experienced great relief after the passage of flatus.

The temperature, after the rigor, soon went down to normal, and then varied between 100° F. and 97° F. for the rest of her illness, the temperature being generally just under

99° F. It always went down a little after an action of the bowels.

The abdomen always remained very slightly distended and tympanitic, and she complained of a feeling of pressure there, but, although there was a general feeling of tenderness, it was impossible to absolutely locate any point as very tender or painful. On one occasion, however, I thought I elicited a definitely painful area over the sigmoid, but only to subsequently find it absent. Every part of the abdomen, when first touched, was said to be painful, but, after conversing with the patient a short time, the pain was generally declared to be absent on further palpation. On the last two days of her illness the transverse colon stood out occasionally, and peristaltic movement was also observed.

Vomiting continued on and off for the five weeks, but there were sometimes days in which it ceased. As a rule, she was sick twice or thrice in the 24 hours. The first vomited matter consisted of the contents of the stomach, and was followed by a thin bile-stained vomit. There was never, so far as I am aware, any stercoraceous odour in the breath or vomited material. Towards the end, the vomit was almost clear and watery looking, but had a deposit of that brown material which is often seen at the bottom of a cup of beef-tea.

The pulse was, in the early part of her illness, about 90 per minute, but it afterwards went to over 100, and became more feeble, ultimately being only just perceptible.

There was throughout no trouble with the urine, which upon analysis was normal.

She was fed by rectal enules of meat and milk, and also a little food was given by the mouth when her stomach was able to tolerate it. Still, when nothing else was retained by stomach, cold water was practically always retained.

I may mention that she did not become materially thinner until the last week or so of her illness, and also that nothing definite was ever felt abdominally. She was given carminatives and fomentations, and also, when necessary, morphia, the last-mentioned being especially useful at night time.

Having now enumerated all the chief details of the case, I think that it will prove interesting to note the opinions of the nine medical men in the order of their seeing the case.

I. General practitioner. Ptomaine poisoning, neurosis ?, some obscure abdominal condition.

II. General practitioner. Same as I.

III. General practitioner. Probably some intestinal ulcer, neurosis.

IV. General practitioner. Colitis and neurosis.

V. Consulting physician. Ptomaine poisoning, neurosis. He looked upon the temperature chart as typical of ptomaine poisoning.

VI. Consulting surgeon. Hysteria. Found two small abdominal glands, which were slightly palpable per rectum, and probably tubercular, but glands said to have nothing to do with present illness. He thought the temperature would do typically for tubercular peritonitis.

VII. Consulting surgeon. Hysteria. The temperature said to be typically hysterical.

VIII. Consulting physician. Partial obstruction of the bowels, hysteria ?, also Addison's disease.

IX. Consulting surgeon. Partial obstruction of the bowels, probably, near sigmoid flexure, in a hysterical subject.

After the patient's illness had lasted five weeks, an abdominal section was done by Mr. H. J. Waring, M.S., F.R.C.S., in order to ascertain the cause of the partial obstruction, and to do what was necessary for the cure of the condition. He has kindly allowed me to insert his report as follows :—

" A growth was situated in the sigmoid flexure of the colon, immediately above the brim of the pelvis, in the left side. About two-thirds of an inch of the long axis of the bowel and the entire circumference, was the seat of a hard growth, which was annular in form, and so narrowed the lumen that only the tip of the finger could be passed into it. There were several adhesions between the colon and the upper aspect of the left ovary, whilst a segment of the lower part of the ileum was attached to the colon and involved in the adhesions. The ileum was detached from the adhesions and the growth in the colon, and a hole, two-thirds of an inch long, closed by sutures. The annular growth was incised, and end to end anastomosis performed. The growth of the colon histologically was found to be a typical columnar-celled carcinoma." The patient died shortly after the operation was finished. It will possibly be wondered at that not one of the nine opinions suggested carcinoma, but in a young lady of 31 years, who, barring the last few weeks of her illness, had not been getting thinner, and in whom no growth, or glands, was palpable, the error is, I think, a very excusable one, more particularly as the insufficient nourishment would account for the little loss of weight. It is true that one surgeon felt some glands in the abdomen four days before her death, but which he believed to be tubercular and quite unconnected with her illness. I made a rectal examination ten days before death, and felt no glands there, but the day before operation I distinctly felt two very small gland-like bodies upon the sacrum. On this day also, for the first time, the colon stood out and peristaltic action was seen. Early on this same day, when giving the patient an enema, I found that the fluid instead of going in freely as usual, was returned after about fifteen ounces had entered the bowel, and no alteration in the position of the soft rubber tube made any difference. Thus it will be seen that the symptoms and signs had suddenly become much more pronounced the day before death, and consequently the physician and surgeon who saw her on that day were at a distinct advantage over the others. In fact so changed had the patient suddenly become that she looked to be dying. She had certainly not, previously to this illness, shown hysterical symptoms and the hysteria was, I presume, due to the condition of the left ovary, found by Mr. Waring at the operation. It certainly appeared peculiar that, four days before death, when the patient was told by two surgeons separately that she could help her symptoms, and must keep down her food, she managed to resist the desire to vomit almost entirely for nearly 36 hours. Again, the fact that the seat of pain in the abdomen was continually shifting was suggestive, although, when examined during the last few days per rectum, she complained of intense pain when the finger was pushed up towards the sigmoid flexure.

The cause of the initial rigor seems difficult to explain unless it was due to some toxic condition of the bowel (she certainly had not eaten any food which could have caused ptomaine poisoning), or local inflammation; but the difficulty of explaining a temperature chart is seen by three distinct opinions being given by three of the specialists in regard to it, namely :—

(1) That it was typical of ptomaine poisoning ;

(2) That it was typical of hysteria ;

(3) That it would do for a typical chart of tubercular peritonitis.

It will be noted that all nine opinions contained the word neurosis or hysteria, and hence there can be no doubt about the predominating presence of the hysterical symptoms, but still the majority of the opinions were for something more than hysteria, and the fact that ultimately neither calomel, castor oil, nor apenta water had the remotest effect, made it quite evident that there must be some obstruction, although of a partial nature as evidenced by the passage of flatus. Then again, as she was fed almost entirely per rectum, there was practically no appreciable increase in the size of the abdomen before the last few days, and then it was by no means considerable ; but when the transverse colon stood out and peristalsis was observed, together with the return of the enema after 15 ounces had been given, and the now decided vomiting, and above all that there had been no action of the bowels for over a week, notwithstanding the giving of medicines for the purpose, it made the diagnosis of obstruction beyond doubt. If I may say it, I think that the moral to be deduced from this case is to never diagnose a case as simply hysterical, until we have, beyond the possibility of doubt, absolutely excluded hysteria as being due to some obscure cause.

NOTES FROM FOREIGN JOURNALS.

AN ADHERENT OINTMENT.

Danlos, at the Hôpital Saint Louis, makes use, in different skin affections, especially in psoriasis, of an ointment which has the advantage of being very adherent to the skin, and which can only be removed by the use of oil or soap. The formula is:—

℞. Ol. Cadini	ʒiss.
Pulv. Talci	℥ss.
Pulv. Zinci Oxidi	ʒij.

Misce. Fiat unguentum.

The preparation entails a lengthy trituration.

For the patient the application is much more agreeable than that of oil of cade in the form of glycerole. It is not so cold, and does not soil linen. Owing to its adherent property, it does not require to be renewed every day, a fresh application need only be made every other day. It is specially indicated in psoriasis, but can be used with advantage in other obstinate lesions, such as eczema, with lively irritation. Its adherent properties make it useful in many other circumstances.

At the same institution, Danlos is now using, for the treatment of ulcer of the leg, an ointment which gives better results than all other means he has tried:—

℞. Ung. Ferri Peroxid. Hydrat.	partes æquales.
Ung. Styracis	
Ol. Olivæ	

Misce. Fiat unguentum.

In cold weather, the amount of oil must be increased. The ointment is applied spread on gauze, or, better still, on silk-protective, and must be changed daily. Skinning over is said to occur quickly.—(*Journal de Médecine.*)

TREATMENT OF PLANTAR HYPERIDROSIS.

Chandèze draws attention to a simple method of treating this noisome affection. It consists in swabbing the feet with a 5 per cent. solution of picric acid in absolute alcohol. It is based upon the keratogenous and analgesic properties of picric acid, as exhibited in the treatment of burns. Picric acid has a marked affinity for epidermis macerated with sweat, and for papillary surfaces denuded of epidermis. When the foot is swabbed, the alcohol evaporates at once, leaving, at all points touched by the swab, a powdery layer of picric acid. Healthy skin is not appreciably altered, but the picric acid appears to combine with the macerated cuticle, and this hardens almost immediately, becoming parchment-like, and having the colour of mahogany by the following day. The immediate effect is the disappearance of the pain, the smell, and of the sweat itself. Men who previously had been scarcely able to bear the pressure of their boots, when treated in this way, are able to rejoin the ranks in a very short time, and to make the longest marches without difficulty. No contra-indications to the use of picric acid have been noted; the application produces a slight burning sensation where papillæ are exposed. This is due to the alcohol and soon passes off, being replaced by the insensitiveness produced by the picric acid. This allows the man to get into his boots again at once. The effect is increased if, after swabbing, the foot or the sock is well powdered with bismuth or talc. Chandèze, with a moist cloth, first removes from the feet the sweat and dust, and then, with a swab of wool on the end of a rod, applies one or two coats of the solution over the sole and between the toes, paying particular attention to places where the skin is thin. As soon as these are dry, the feet are clad. If the feet are in very bad condition, the skin thin, macerated, and bleeding, the dressing is done twice on the first day of treatment, and then once a day for three or four days. In order to keep up the effect, a daily application for a week is advisable.

Abrasions from rubbing of the shoe should be treated in the same way, and will soon heal. Blisters must be well opened near the edge, the contents emptied completely without removing the raised epidermis, and a little of the solution allowed to flow in. This produces some smarting, which soon passes off, while the blister becomes painless, never gets inflamed, and is soon healed. A powder, which gives good results alone or concurrently with swabbings, is composed thus:—

℞.	Aristol.,	
	Alumnol.,	
	Acid. Picric.	āā gr. xl.
	Dermatol.	℥ss.
	Pulv. Talci	℥iss.

Misce. Fiat pulvis.

A disadvantage, which attaches to picric acid preparations, is that they give a canary-yellow colour to linen, which disappears, however, at the first washing.—(*Journal de Médecine.*)

TREATMENT OF CATARRHAL LARYNGITIS AND TEMPORARY CONGESTION IN SINGERS.

The Journal de Médecine et Chirurgie extracts the following from Moure and Brindel's newly-published *Guide pratique des maladies de la gorge et du larynx*, relative to the treatment of catarrhal laryngitis, the chronic form of which is usually the consequence of repeated acute attacks, which are due to prolonged vocal efforts, and to mismanagement of the voice, occurring in those predisposed thereto by alcohol, tobacco, rheumatism, etc. The laryngitis shows itself by a more or less pronounced hoarseness, more noticeable, as a rule, on waking in the morning, and a difficulty in producing sounds, by a feeling of tingling at the level of the larynx, and a constant desire to expectorate, and also by a matutinal expectoration of viscid mucus like pearl-barley. Treatment must aim at removal of the cause, and be dietetic and antiphlogistic; the voice must be rested; nasal or naso-pharyngeal lesions must be remedied; and the larynx sprayed with the following, by means of a steam-spray, for five minutes morning and evening:—

℞.	Sod. Boratis,	
	Potass. Bromidi	āā ʒiss.
	Sp. Menth. Pip.	ʒiij.
	Glycerini	℥ij.
	Aq.	ad ℥xvj.

Misce. Ft. lotio.

The mucous membrane requires to be touched twice a week with a solution of chloride of zinc (4 per cent.) or of nitrate of silver (3 per cent.).

The laryngitis of singers, produced by misuse or overwork of the voice, is made evident by redness, temporary congestion, and especially by muscular troubles (vocal asynergy). The following is useful:—

℞. Tinct. Aconiti	ʒss.
Potass. Bromidi	ʒi.
Sod. Benzoat.	ʒij.
Syrup.	℥i.
Aq. Laurocerasi	℥ss.
Aq. Tiliæ.	ad ℥vj.

Misce. Ft. mistura. Cap. ℥ss. ter v. quatuor quotidie

The dose should be taken in some warm pectoral infusion.

MUSHROOM-POISONING.

Maher publishes a long article, in the *La Clinique*, on the treatment to be adopted in these cases. To some extent, one must be guided by the symptoms produced, and the particular sort of fungus eaten; but, in every case, the first thing to do is to get rid of the toxic matters from the alimentary system, first by emetics, and then by purgatives. Ipecacuanha is preferable to tartar emetic, because of the depressing effect of the latter, which would increase the danger when muscarine is present from ingestion of Amanita muscaria.

In order to obtain a rapid effect, the following should be given:—

℞. Pulv. Ipecac.	gr. xx–xxv.
Antim. Tart.	gr. $\frac{3}{4}$.

Misce. Ft. pulv.

To be mixed with four glasses of warm water, and taken in two or four doses.

In cases which have gone too far to vomit, the stomach must be washed out by means of the œsophageal catheter, and by this can be administered stimulants, such as coffee, acetate of ammonia, or ether. When the jaws are closed firmly, or in the case of unruly children, apomorphia may be given subcutaneously, $\frac{1}{3}$rd of a grain to adults, $\frac{1}{10}$th to $\frac{1}{6}$th of a grain to children. Happily, as a rule, the first effect of the poisonous fungus is to produce vomiting, or an intestinal *débâcle*. These may be encouraged by giving plenty of warm salt water, olive oil, or sulphate of copper.

℞. Cupri Sulph.	gr. iss.
Pulv. Sacchar.	ʒi. M.

Dissolved in two or three tablespoonfuls of water, and repeated twice or thrice.

When the stomach is empty, give milk, mucilage water, linseed-tea, or albumen-water. Boudies advises a small dose of iodide of potash as an antidote to muscarine.

℞. Potass. Iodidi	gr. ij.
Tinct. Iodi	♏i.
Aq.	℥ss. M.

It is well to follow up the emetic treatment with a good purge by means of 20 gm. (ʒv.) of sulphate of soda or magnesia. Drastic purgatives like jalap and senna should be avoided. The abdomen may be well rubbed with—

℞. Tinct. Opii - - - - - ʒi.
Chloroformi - - - - - - ʒij.
Tinct. Belladonnæ - - - - ʒv.
Linimenti Camphoræ - - - - ad ℥iv.
M. Ft. linimentum.

An empirical antidote to poisonous fungi is in current use in the Cevennes, in the shape of large doses of powdered charcoal, animal or vegetable. The emetic is best given beforehand, but may follow the charcoal with equal advantage.

TREATMENT OF ERYSIPELAS BY METACRESOLANYTOL.

Neumann reports in the *Berlin. klin. Wochenschr.* on the effects obtained in 12 cases of facial erysipelas, and 11 of erysipelas in the trunk, originating in wounds. The substance used is a syrupy liquid, which looks and smells like ichthyol. It is easily soluble and not caustic. The application produces a hardening of the area treated, followed by exfoliation in crusts or scales, but not by suppuration or scars. No harmful secondary effects have been noticed. Neumann applies the liquid in its pure state, and begins about 10 cm. (4 inches) from the lesion, and covers the whole area (wound included). This is repeated several times, and the surface soon becomes dry and varnished. The temperature falls, and the spread of the infection is stopped, even after one application, but it is always wise to continue, as a fresh attack may develop on the third day. Oil or boric vaseline helps to remove the scales more quickly. In recent cases, the temperature falls in twenty-four to forty-eight hours. If no result is obtained, there is reason to suspect the formation of an abscess.

LEUCHÆMIA LYMPHATICA CURED BY X-RAYS.

Kienbock, at a meeting of the Vienna Medical Society, showed a case of this disease cured by X-rays. Four years previously, the patient was extremely weak, and showed glandular swellings. A blood-count, made two years ago, showed: Red cells, 5,000,000; white cells, 185,000; hæmoglobin, 15·9 per cent. Treatment by X-rays was then begun, with the result that the glands and the spleen got smaller, the number of red cells diminished, and the general condition improved. During the time, treatment was for a while suspended, and the symptoms reappeared, but subsided when the treatment was resumed.

Practical Notes.

THE LACHRYMAL APPARATUS.—This consists of the lachrymal glands and lachrymal passages. In structure, each lachrymal gland is a racemose gland, microscopically like the parotid gland. Each gland consists of two portions, the superior or orbital portion, which is about the size of a small almond, is situated in the lachrymal fossa at the outer part of the orbital plate of the frontal bone, just internal to its external angular process, and is fixed by fibrous bands to the periosteum. There are about twelve lachrymal ducts, which pass from this portion of the gland, and which open upon the surface of the conjunctiva at the outer portion of the upper fornix. The inferior or palpebral portion of the lachrymal gland consists of one or two lobules, which are situated on the course of the ducts of the superior or orbital portion. This part of the gland can be readily seen under the conjunctiva, when the eyeball is rolled downwards and inwards. The accessory lachrymal glands, or Krause's glands, are small acini, which lie below the conjunctiva between the fornix and the edge of the tarsus. There are between forty and fifty of these glands in the upper fornix, and from six to eight in the lower. The lachrymal passages consist of the puncta lachrymalia, situated on the lachrymal papillæ, the upper and lower canaliculi, the lachrymal sac, and the nasal duct. The puncta lie at the posterior border of the lid margin near the inner canthus of the eye, and are in apposition to the eyeball. The canaliculi pass from the upper and lower puncta to the lachrymal sac, where they open, as a rule, separately into its outer wall. The lachrymal sac, which, when distended, measures about 14 mm. vertically and 5 mm. horizontally, lies in the lachrymal fossa in the lachrymal bone. Fibres of the orbicularis palpebrarum surround the lachrymal sac. The lower end of the lachrymal sac narrows down considerably to open into the nasal duct. Near its superior extremity, the lachrymal sac is crossed in front by the internal tarsal ligament, from the upper and lower edges of which the orbicularis palpebrarum arises; behind the lachrymal sac is the tensor tarsi muscle or muscle of Horner. The nasal duct, which measures between 15 and 20 mm. long, passes downwards, backwards and slightly outwards in the canal formed by the superior maxilla and the inferior turbinated bone, to open at the anterior portion of the outer wall of the inferior meatus of the nose. Here the mucous membrane forms an imperfect valve (valve of Hasner), as the duct opens into the nose. The lower portion of the nasal duct is surrounded by a plexus of veins, forming a sort of erectile tissue similar to that in the nose.

THE LACHRYMAL SECRETION.—This is a slightly alkaline fluid, the chief constituent of which is sodium chloride. The amount secreted, under normal conditions, is just sufficient to moisten the conjunctiva, and is then gradually lost by evaporation. It is only when the lachrymal gland is stimulated through a psychical disturbance, or reflexly through the periphery, such as a foreign body in the conjunctival sac, a superficial corneal ulcer, or reflex irritation through the nasal mucous membrane that there is an increased amount of the fluid secreted; this for the most part is forced into the lachrymal sac, and through the nasal duct into the nose during the movement of the eyelids when the fibres of the orbicularis palpebrarum contract around the lachrymal sac; but some of the secretion may pass over on to the face, constituting *epiphora*. In normal circumstances, it is the lubrication of the margins of the lids by a fatty material which prevents the tears from flowing over on to the cheek. It is quite possible that the lachrymal secretion may have some slight antiseptic properties, at any rate, to a great extent, it keeps the conjunctival sac clear from invasion by many micro-organisms, and, in this connection, it is interesting to note that there are no tears secreted during the first few weeks of life, and this may explain the fact that micro-organisms, like the gonococci and others, so readily infect the conjunctival sac of the newly born child, and produce ophthalmia neonatorum.

ÆTIOLOGY OF TUBERCULOSIS.—In an address delivered by Professor Marzÿck P. Ravenel, published in the *American Journal of the Medical Sciences*, there is an interesting account of the ætiology of tuberculosis. Many facts, some of which are experimental, while others are accidental, are introduced to prove that the infection of tubercle frequently occurs through the alimentary canal. The spread of tuberculosis amongst swine and other animals, through the use of skimmed milk and the waste products of creameries, is mentioned. It is shown that the tonsils, experimentally, may be readily infected with tubercle by direct application, as well as by feeding animals on tuberculous material. Grober, after careful study of the question, concludes that the infection through the tonsil is one of the most frequent causes of apical tuberculosis. From his experiments, he has demonstrated that, from the cervical lymphatic glands, there is a direct route to the pleuræ and lungs, and that opens the way to involvement of the apex of the lung in the disease. It is well known that the small intestine is frequently involved in cases of phthisis, and that the lesion is, in most cases, secondary, due to the sputum, laden with tubercle bacilli, which has been swallowed, when the bacilli have resisted the action of the pepsin-hydrochloric acid of the gastric juice. It must be borne in mind, however, that the bacilli may have gained an entrance to the body, in the first place, by way of the alimentary canal. The mucous membrane of the intestine, which, in children, is looser, and the epithelium more delicate, is more liable to be infected in the young than in adults, or older persons. Moreover, the intestinal catarrhs, to which children are particularly liable, tend to lessen the natural resistance of the cells in the mucous membrane to the invasion of micro-organisms. Primary infection through the intestine is certainly of frequent occurrence, and Professor Ravenel writes: "Numerous experiments long ago convinced me that an infection through the alimentary canal often shows itself first in the thorax; and I believe it is unfair to consider, as cases of intestinal infection, only those, in which the primary lesion is found in the intestine or mesenteric glands. The question hinges largely on the ability of the tubercle bacillus to pass through the intestinal wall without causing a lesion at the point of entrance."

The conclusions drawn by Professor Ravenel, from his own researches and those of others, are as follow:—

"1. The alimentary canal is a frequent portal of entry for the tubercle bacillus; 2. The tubercle bacillus is able to pass through the intact mucous membrane of the alimentary tract, without producing a lesion at the point of entrance. This takes place most readily during the absorption of fats; 3. The bacilli pass, with the chyle, through the lacteals and thoracic duct into the blood, which conveys them to the lungs, where they are retained largely by the filtering action of the tissues; 4. Infection through the alimentary tract is especially frequent in children; 5. Milk from tuberculous cows is the source of infection in many cases. Our present knowledge does not enable us to state the exact proportion of cases of tuberculosis due to this cause, but it is probably considerable; 6. Tuberculosis can be communicated by contact, such as kissing, soiled hands, accidental injuries in post-mortem work, or during the cleansing of vessels used by consumptives, etc. These modes of infection play a comparatively small part in the dissemination of the disease."

Prescriptions.—For cases of chronic pulmonary tuberculosis Dr. R. W. Philip advocates the use of creosote in large and increasing doses, which must be used during a prolonged period. Guaiacol, which has the same active principle as creosote, is the drug usually prescribed, and may be given in solution as follows:—

℞	Guaiacol - - - -	part 1.
	Alcohol (90 per cent.) - - -	parts 20.
	Aq. - - - - -	parts 180.

One to three teaspoonfuls to be taken twice or three times daily, or the Mistura Guaiacol of the Guy's Hospital Pharmacopœia may be given:—

℞	Guaiacol - - - -	♏iv.
	Alcohol (90 per cent.) - - -	♏xl.
	Glycerini - - - -	♏xxx.
	Ol. Cinnam. - - - - -	♏i.
	Aq. - - - - ad	℥i.
	Misce. Ft. Mist.	

If the guaiacol causes the mucous membrane of the stomach to become irritable, the following combination is suggested:—

℞	Guaiacol Carbonat. - - -	gr. iv.
	Acidi Arsenios. - - -	gr. $\frac{1}{60}$.
	Ft. pil.	

One to three pills to be taken three times daily.

Notes by the Way.

Sanitation in Rural Districts.

THE common belief that our country districts are delightfully healthy will be rudely shaken by a perusal of the "Return of the Medical Officers of Health and Inspectors of Nuisances in the Rural Districts of each County in England and Wales," moved for, in the House of Commons, by Sir John Dickson-Poynder, and by a reference to recent reports to the Local Government Board by some of their Medical Inspectors. We are reminded, by this reference, of two pictures, which appeared not long ago, in one of our leading illustrated comic papers. One of these represented some visitors enjoying their tea in the garden of a farmhouse, and one of the young ladies as saying, "How delightful to know that this tea is made with water drawn from a well on the premises"; the other depicted the appearance on the scene of a clodhopper, who held by the tail a miserable-looking dead cat, and exclaimed, "Here's th'ould cat that I've fished out o' the well!" The Return shows that there are only four single rural districts, of which the Medical Officer of Health gives his whole time to the duties of his office, that an exceedingly large proportion—roughly, five out of seven—are engaged in private practice, and that roughly six out of seven Inspectors of Nuisances hold other appointments, or follow some private occupation. One of these inspectors is a master smith, and a poultry fancier and dealer; another, in a district of nearly 60,000 acres, with a population of over 14,000, is a Highway Surveyor, Inspector under Petroleum Acts, Collector to Board of Guardians, Vaccination Officer, Registrar of Births, Deaths, and Marriages, and Collector of Income Tax. It would not be surprising if an occasional unwholesome dwelling, or a polluted well, escaped the notice of these gentlemen. Moreover, we are profoundly of opinion that a Medical Officer of Health, if he is to perform his duties satisfactorily, should be freed from the exacting, and possibly conflicting, duties of a private practice. At the same time, he should be independent of the favour or disfavour of local authorities, for there is no doubt that his official duties might bring him into collision with those, upon whose goodwill, in reference to private practice, he is more or less dependent, or to whose favour he owes a precarious position.

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Revolting Admissions.

In these circumstances, it is not surprising to find that nuisances exist, which might sing, like Tennyson's brook, "Men may come and men may go, but I go on for ever." We know that, on the whole, especially in large towns, sanitation is attempted, with a considerable amount of success, while, in many rural districts, it is practically or altogether unknown.

In reference to the supply of milk, it is well known that the utmost care, with regard to the cleanliness of cowsheds, etc., should be exercised; it is therefore scarcely credible that such reports as the following, issued by Local Government Board Inspectors in July, August, and September of this year, should be possible. We give *ipsissima verba*:—

"Some of these shippons were formerly cottages, but attempts have been made to render them fit for the housing of cows. They are dark, dirty, ill drained, badly ventilated, and dilapidated. . . . The upper portion of these shippons had been used some time ago for plucking geese, fowls, etc., and the upper floor was some inches deep in feathers, dust, and refuse of all kinds. The walls of the whole building were covered with cobwebs, and a place more unfit for cow-keeping and milk production can hardly be imagined."

"No attempt is made to keep the cattle clean, or to cleanse the teats or the milkers' hands before milking. The dairies are, in nearly all cases, mere cupboards, often without light or ventilation, cut off from the living room by a loose partition only, and they are nearly always also used as pantries or larders. Frequently an accumulation of stinking filth, manurial or otherwise, is placed beneath the only opening by which fresh air can enter the so-called dairy."

"The prevailing characteristic of cowsheds in this district is dirt. Of the numerous cowsheds that came under my observation, only two or three were tolerably clean, while many were absolutely filthy."

The reports as to the disposal and removal of excrement and refuse are deplorable and revolting. In fact it is difficult for any one, unacquainted with country districts, to believe in the existence of such insanitary conditions, but the fact that they do exist, calls loudly for the independent appointment of medical officers of health, and of properly qualified inspectors of nuisances, whose whole time should be devoted to the execution of their duties.

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Summer Diarrhœa.

It is pretty evident that a crusade of extermination should be undertaken against the common house-fly, and that every precaution should be taken, especially in the summer months, against the storage of heaps of refuse, manure, and putrid matter, which invite the deposit of fly eggs, if the mortality of infants from summer diarrhœa is to be checked. In May 1906, we published an article by Dr. Nash, the Medical Officer of Health for Southend, in which he clearly pointed out the part played by the common house-fly in producing infantile diarrhœa, and, in the October issue of THE PRACTITIONER, we published an article on the same subject by Dr. Bridge, late of Devonport, in which he referred to the harmful effects of the unremitting attention, to persons and food, of these household pests. It now appears that Dr. Edmund M. Smith, the Medical Officer of Health for the City of York, whose courteous communication we gratefully acknowledge, issued an exceedingly useful leaflet in 1903, in which he enumerated the causes of summer diarrhœa amongst children, and warned his constituents against the mischievous effects of flies. The warnings of these three gentlemen are too serious to be disregarded, and we have no hesitation in saying, in the interest of the children, and, consequently, of the State itself, that a war of extermination against the common house-fly should be proclaimed, and carried on to a successful termination.

Dr. Bridge suggested in his article, that milk should be delivered to the dairy where it is to be sold in sealed cans direct from the place where the cows are milked, and in this, Dr. Smith entirely agrees with him, but, in view of the reports of the Medical Officers of the Local Government Board, to which we have drawn attention above, some stringent measures, for the purpose of ensuring the production of clean and uncontaminated milk, are urgently required, for, as Dr. Bridge, quoting Dr. Newman, says: "It cannot be too clearly understood that sterilisation does not make bad milk good, or dirty milk clean."

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The Disguises of Aspasia.

THE science of advertising has of late years made such rapid strides that, as a system, it might be said to have almost reached perfection. With good, wholesome, bold advertisement we have no quarrel, but we think that the growing tendency to put laudatory matter into an advertisement, which appears in a respectable journal, and then to announce it, in subsequent advertisement, as the publicly-expressed opinion of that journal, is one to which serious objection has recently been rightly taken. Still another scandal, and it is indeed a scandal, is the insertion, in respectable mediums for advertising, of what we may term a veiled advertisement. The action of local authorities in driving Aspasia, and her more shameless followers, from off the public streets, has led, amongst other devices, to a system of disguise. Hence it happens that, included among the advertisements of nursing homes, and institutions for massage, etc., are advertisements of places in which Aspasia revels uncontrolled. It is on behalf of the unwary that we would make an appeal. We would respectfully urge upon all medical practitioners, when recommending a patient to go to a nursing home, or to take a course of massage or similar treatment, to include, in that recommendation, the name of such an establishment as is altogether above suspicion. It is intolerable that Aspasia should adopt as a disguise one of the noblest callings, to which her purer sisters can devote themselves.

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The Cause of Labour.

AT the first meeting of the Obstetrical and Gynæcological Section of the Royal Society of Medicine, an epidiascopic demonstration, of exceptional interest, on "The Physiological Action of the Placenta," was given by Dr. Frank E. Taylor, in which he demonstrated the results which, in co-operation with Professor W. E. Dixon, he had obtained in an investigation into the physiological action of placental extracts. These extracts were prepared by mincing human placentæ, extracting with absolute alcohol, and dissolving the residue, after evaporating to dryness, in normal saline solution. This extract was injected, intravenously, into cats, rabbits, and dogs, with the same results in each case. There was a striking alteration in the blood pressure, which, after a preliminary slight fall, was powerfully raised in a manner very similar to that produced by adrenalin. This rise in blood pressure was due mainly to a constriction of the peripheral blood vessels, the heart being very little affected. As regards the uterus, the results differed in the pregnant and non-pregnant condition. The muscle tonus of the pregnant uterus was increased, and the normal rhythmic contractions were greatly exaggerated, whilst, in the non-pregnant uterus, relaxation of the muscle fibres resulted. The effect upon other plain muscle was also similar to that of adrenalin, the intestinal movements, for example, being inhibited.

These experiments are of great interest, and place the functions of the placenta in an entirely new light, for the experimenters believe that the substance, which they have shown the placenta to contain, is that which provides the physiological stimulus for the onset of labour, and that it is by the ripening of the placenta, and the liberation of a chemical substance that this function is established. The theories, which have been put forward, at various times, to account for the cause of labour are many and ingenious, but none of them are convincing. The most probable theory was the bio-chemical one, but no chemical substance, which might have had this action, has hitherto been experimentally demonstrated. Moreover, seeing that the placenta contains a chemical substance, which stimulates the uterus to contract, there would seem to be a sound physiological basis for the instinct possessed by most animals—herbivorous as well as carnivorous—of eating their placentæ. They thus, probably, preserve themselves from post-partum hæmorrhage, from subinvolution, and other evil effects, which result from inefficient uterine contraction.

* * * * *

Utile Dulci. "THEY order this matter better in France," quoth our immortal humorist at the outset of his Sentimental Journey, and the remark recurred to us, with enhanced appreciation, on reading the excellent arrangements made for the ninth annual *Voyages d'études médicales* in September. Starting from Rheims, the tourists made a fortnight's journey through the Vosges and Jura districts, visiting the spas and health resorts, including, among others, Vittel, Contrexéville, Plombières, Besançon, and Salins. The railways and municipalities concerned combined to offer facilities and welcome to the tourists, and every opportunity was afforded to the studious to acquaint themselves, at first hand, with the particular merits of each place visited. The cost per head was 300 francs, which covered all travelling and hotel expenses. Why cannot something of the same sort be done in England? There are plenty of men in practice, who would gladly avail themselves of a chance of personally obtaining some definite ideas about the various spas at home, many of which are, to say the least, quite equal to the best abroad. It is all very well for the "poet of Empire" to make his moan as to "what should they know of England who only England know," but the pity of it is that there are so very few who can be said to know England. And yet "'tis very well worth the knowing." What better holiday can be imagined than a well-arranged motor tour, including some of our English spas? It would offer the additional advantage of seeing, at the same time, something of our own good land. For instance, the Bath to Leamington district could be taken one year, the Buxton-Harrogate in another, leaving Wales to provide the touring ground, a veritable *pièce de résistance*, for a third. Well devised, and managed with capability, such a scheme positively teems with possibilities for enjoyment *frappé à goût* with a little useful knowledge—sleep on in peace, dear Mr. Barlow—but it must be borne in mind that to get the most out of such a plan, motoring must form an indispensable ingredient.

◆

Preparations, Inventions, etc.

INVALID AND DIABETIC FOODS.

(Messrs. Bonthron & Co., 50 & 52, Glasshouse Street,
London, W.)

Biogene.—This is a pure milk proteid, rich in phosphates and readily soluble. It is obtained from fresh English milk, and is free from starch and sugar. For invalids, it makes a strengthening addition to beef tea, soup, milk, tea, and other hot liquids, and it can be added, before cooking, to farinaceous foods with distinct advantage. For domestic purposes, its use affords great dietetic opportunities, and, as it is supplied in the form of a white powder, its adaptability will be at once appreciated.

Biogene Biscuits, Wafers, and Cocoa.—Very useful preparations of Biogene are to be obtained in these forms, and, as Biogene is both starchless and sugarless, they are especially suited for diabetic patients.

BROMURAL.

(Messrs. Knoll & Co., 8, Harp Lane, London, E.C.)

Bromural is a bromide of the valerian group (Monobromisovalerianyl-urea), and, as a nerve sedative and mild hypnotic, occupies an intermediate position between the bromide and valerian preparations on the one hand, and the hypnotics, such as trional and veronal, on the other. When given in doses of from 5 to 10 grains it produces a restful sleep after an interval of 5 to 25 minutes, and causes no by- or after- effects. Its soporific effect wears off in from 3 to 5 hours, and is then generally followed by a natural sleep, from which, so far as we are able to ascertain, the induced sleep differs in no important respect.

INFANTINA.

(Dr. Theinhardt's Food Company, 6, Catherine Court,
Seething Lane, London, E.C.)

In these days, when attention is being seriously directed to the excessive infant mortality, and, when it is recognised that this mortality is especially observable in the cases of bottle-fed children, suitable food for infants is very necessary. We are asked to draw attention to the fact that the well-known *Theinhardt's Soluble Infants' Food*, which is particularly useful for bottle-fed children, who are unable to digest cow's milk, is now known by the name of "*Infantina.*"

When it is desired to give to invalids, or nursing mothers, as much nourishment as possible in the smallest volume, "Hygiama," another preparation of Dr. Theinhardt's Company, will be found an exceedingly valuable food.

MEDICAL DRESS.

(Mr. John J. M. Bult, 140, Fenchurch Street, London, E.C.)

It was a well understood thing a few years ago that doctors, as well as clergymen, should be recognised by their distinctive style of dress. Now, however, in these days of motor cars and cycles, primness of appearance has had to give place to a more utilitarian form of apparel. Still we must confess to a strong predilection in favour of the frock coat, and, both as regards style and material, Mr. Bult satisfies the most exacting professional mind with reference to this particular article of dress. The smartness inseparable from all of Mr. Bult's work cannot fail to secure for him hearty commendation among the members of the medical profession.

TABLOID.

(Messrs. Burroughs Wellcome & Co., London, E.C.)

'Tabloid' Capsule Calcium Iodo-ricinoleate.—Calcium iodo-ricinoleate is a new salt, containing a large proportion of iodine, which combines the therapeutic value of calcium and the iodides. It is tasteless and odourless, and is not affected by the gastric juice. It gives rise to no digestive disturbance, and is well tolerated by patients who cannot take potassium or sodium iodide. Its action, in syphilitic cases, compares favourably with the result of treatment by the iodides, while in stubborn cases of ulcers, including rodent ulcer, it has proved very successful. The 'Tabloid' Capsule, gr. 3 (·194 gm.), for therapeutic purposes, offers a very convenient and satisfactory method of administration.

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